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REPORT

OF THE

Mass:

COMMISSIONERS

ON

FISHERIES AND GAME

FOR THE

YEAR ENDING DECEMBER 31, 1905.



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Commonwealth of Massachusetts.

To His Excellency the Governor and the Honorable Council.

The Commissioners on Fisheries and Game respectfully submit their fortieth annual report.

GENERAL CONSIDERATIONS.

Appropriations. — The total amount appropriated and available for the various branches of the work for the year 1905 was \$52,165. The distribution of the various amounts is definitely fixed by law. In general, \$9,000 was designated for use in connection with the sea and shore fisheries; approximately \$5,700 was used for the benefit of the inland fisheries and game, in the propagation of fish, pheasants and hares, and the stocking of ponds, streams and covers; approximately \$26,000 was expended in enforcement of law, both on land and on the sea coast; for salaries of the commissioners, \$5,620; and approximately, \$3,500 for printing, postage, clerical and office expenses, and travelling expenses of the commissioners. The exact details of expenditures are to be found in the report of the Auditor of the Commonwealth.

Since 1866, when this department had its origin in the necessity for the protection of the fisheries of the Connecticut and Merrimac rivers, the scope and importance of the work of the department has steadily increased. Under its consideration now come: —

(A) The sea and shore fisheries: (1) fresh and cured fish and bait, yielding to the first handlers over \$5,000,000; (2) the mollusk fisheries (clam, scallop, quahaug, oyster and “winkles,” yielding over \$500,000; (3) the lobster industry, producing in 1902 1,005,367 pounds, at about 11 cents per pound, valued at about \$109,725, and in 1905 approximately 500,000 pounds (426,471 lobsters), at about 18 cents per pound, valued at over \$95,000, — a total from the ocean of

\$5,704,000 at first hand, or upwards of \$15,000,000 in the hands of the consumer; (4) the recreation sea fishing (notably in Buzzards Bay), which is capable of very great development.

(B) The inland fisheries, covering the maintenance of the remnants of the fish which our ancestors wisely deemed should belong to all the people in common, but unwisely destroyed in incredible wastefulness. It is our aim to care wisely for this heritage which our fathers so ruthlessly slaughtered and wastefully dissipated.

(C) In a similar way it is our province to protect the few survivors of our formerly abundant game birds and mammals. The wild turkey and the passenger pigeon, the great auk and the "rafts of duck" are gone forever. But by careful consideration the grouse, quail and beneficial birds can not only be maintained, but increased beyond present numbers, thus guaranteeing to the farmer and to the suburban resident the best possible protection against insects injurious to vegetation, and as well against mosquitoes, midges and such annoying pests as are the food of martins, swifts and swallows.

For the direct benefit of the rural population, both permanent and transient, every possible effort should be directed to maintaining and increasing the beneficial, particularly the insectivorous, birds, together with the game birds, notably the quail. For their contribution to healthful sport the grouse family should be increased. Above all, the responsibility of the hunter should be determined. The hunting license now required for unnaturalized, foreign-born inhabitants has done this in a considerable measure. Its more obvious limitation is found in the small number of paid deputies which can be employed for patrol duty.

(D) To this department is entrusted also the enforcement of the fish and game laws, except in the waters of Buzzards Bay, patrolled by the State police boat "Lexington." The enforcement of fish and game laws is notoriously difficult, and demands much special knowledge, careful observation and rapid, accurate judgment. Our aim is to secure a "square deal" for the farmer, the sportsman, the public and the game.

The detailed reports upon these various branches of our work follow under the separate heads.

This department further is daily called upon to furnish information to individuals, to corporate interests, to representatives of foreign governments, to the members of our State Legislature or to the national authorities at Washington. Especially under the direction of our late honored chairman, Capt. J. W. Collins, many facts of economic biology which have been of great commercial value have been very successfully pointed out to our citizens. We trust that these efforts may be sustained.

The most serious handicap upon the work of the commissioners is perhaps the cramped quarters of our single room. Lack of space compels the storage at Winchester of the records of work of previous years; three desks and a stenographer's table leave scant accommodations for the necessary correspondence files, books of reference, specimens, etc. There is not standing room within when all the regular deputies are present. Important work is at the mercy of all sorts and conditions of interruption, so that in this room it has become absolutely impossible to despatch in a satisfactory manner the large amount of routine work which has become necessary, not to mention the special investigations which must be carried out. The seclusion necessary for the rapid and correct disposal of business matters cannot be maintained in the present quarters, to which all persons have direct access. Our late chairman was compelled to establish a private office and work room outside the State House. The present chairman also has found this necessary.

It is a source of satisfaction to note that the efficiency of enforcement of the game laws has been notably increased this year. Unsatisfactory reports have been decidedly less frequent, and those which have been received can be directly traced to: (1) an insufficient number of paid deputies to properly cover the territory; (2) an undeveloped public spirit, which does not forcibly condemn an offence against public property (*e.g.*, fish and game), though vigorously suppressing similar offences against private property; (3) material and verbal defects in certain fish and game laws; (4) a misconception of the fact that this commission does not longer enforce the Sunday fishing laws.

Four of our unpaid deputies have proved recreant, and have been removed. Several have resigned, voluntarily and otherwise.

The commission made a personal investigation of the conditions connected with the winter herring fishery in Newfoundland, in which many Massachusetts vessels engage. All sorts of rumors surrounded the situation. Many Gloucester owners hesitated to send vessels to the treaty coast for herring. The lack of definite information was an effective check upon Yankee enterprise. Upon our return from Newfoundland at North Sydney, Cape Breton, October 12, we had a conference with the masters of the Gloucester fleet, and made known to them the results of our visit to St. Johns, Bay of Islands and other ports and fishing grounds of Newfoundland. We informed them that it was, in our opinion, not within the power or intention of the Newfoundland authorities to interfere with the American rights of fishing on the treaty coast; but that Newfoundland authorities did intend to limit the Americans definitely and strictly to the treaty coast and to the provisions of the treaty, for the purpose of securing to the Newfoundland merchants the pecuniary benefits of the Newfoundland fisheries. In the past the profits have gone to the Newfoundland fishermen and to the Gloucester and Nova Scotian vessels, to the practical exclusion of the Newfoundland merchant. These merchants are now playing the political game for the purpose of securing a share in this trade, which is at present valued at not less than \$500,000 per annum to Massachusetts, and is capable of almost indefinite development.

The commission has made a personal investigation of the lobster industry of the Maritime Provinces and Newfoundland. From the Straits of Belle Isle to St. John, N. B., the evidence and testimony are upon the following points indubitable. Similar reports have been received from Maine, but as yet we have no first-hand knowledge. The average size of the lobster is annually diminishing; the number caught is less; the price is increasing; the number of pots required to supply the demand is greater; to secure a supply, a wider area must be fished; the average catch per pot is less. A constantly increasing number are being marketed, either entire or as meat. Small

lobsters, 8 to 10½ inches, are most satisfactory for eating; they sustain transportation, and reach the market for live lobsters in better condition. Small lobsters are most desirable for canning. The idea of *protecting the adult and marketing only the immature* is spreading. It is now seriously opposed only by persons whose business may be adversely affected (though it is probable that such would prove but temporary), and by the apathy of those who fail to realize that the formulation of the proper lobster laws cannot be left to persons whose sole aim is to make money from the sale of lobsters, without reference to the future supply. The arguments are given on page 190.

The commission has made a personal study of the damage inflicted on the fisheries of this State by dogfish, the results of which are set forth in a part of this report which has also been published separately. (See pp. 95-169.)

Consideration has been given to the shellfish industries of the State, for the purpose of ascertaining the productive capacity of the areas under present conditions inhabited by scallops, clams, quahaugs and oysters, and of advising upon the adoption of the best methods of utilizing and increasing the productive capacity of these areas.

We have definitely ascertained the causes and conditions of the decline of the scallop industry of the State, and have made important recommendations concerning the regulation of the industry. (See pp. 37-41.)

Attention is called to the fact that with our present facilities it is not possible to rear sufficient trout fry and fingerlings to satisfactorily stock the public streams. (See p. 44.) An up-to-date hatchery, with adequate rearing pens, is imperatively needed.

The standards set and maintained by our late honored chairman shall not be lowered, and his words shall still apply: "It is the ambition of this commission to secure the largest results in the public interest for the outlay made. . . . The commission is not cognizant of a single dollar that has been misspent. We hope to merit the continued confidence in the satisfactory and economical disbursement of public moneys."

SEA FISHERIES.

Taken as a whole, this has been a very satisfactory season for the average deep-sea fisherman working for the general market.

The tendency toward the extension of "shack" fishing still continues. This practically accounts for the increasing quantity of fresh fish landed. The strength of the fresh fish market has led to the more thorough exploiting of our own fishing grounds.

The prices of marketable fish of all kinds through the year averaged \$2.41 per hundredweight at Gloucester.

For the year 1905 the total quantity of fish of all kinds landed at Gloucester was 112,459,818 pounds, as compared with 103,528,924 pounds in 1904.

The production of fresh fish during 1905 was a record one. The total number of fishing craft coming to Boston in 1905 was 544. Of this number, 368 were vessels and 176 boats of various kinds, — gasoline boats, launches, etc. The number of trips made was 3,832 in 1905, compared with 4,056 in 1904.

Over 100,000,000 pounds of fresh fish were landed in Boston during 1905, which is a record. The increase was largely in fresh haddock. There was also an increase in halibut and other kinds, but a falling off of 2,000,000 pounds in hake over 1904. The total number of pounds of fresh fish of all species landed in Boston in 1904 was about 86,000,000.

CATCH OF GLOUCESTER VESSELS.	1905.		1904.		1903.	
	Barrels.	Pounds.	Barrels.	Pounds.	Barrels.	Pounds.
Salt cod,	—	18,139,000	—	22,514,600	—	28,371,000
Fresh cod,	—	11,281,060	—	11,564,000	—	9,410,000
Halibut,	—	2,324,700	—	1,970,000	—	3,205,000
Haddock,	—	13,694,190	—	7,274,400	—	3,387,000
Hake,	—	13,517,315	—	11,342,400	—	5,614,900
Cusk,	—	6,895,830	—	4,128,200	—	1,593,000
Pollock,	—	17,637,535	—	8,964,400	—	5,017,700
Filched halibut,	—	453,578	—	742,000	—	652,000
Fresh mackerel,	2,284	456,800	3,240	648,000	3,174	634,800
Salt mackerel,	26,050	5,210,000	25,053	5,010,600	40,161	8,032,200
Fresh herring,	7,257	1,451,400	8,735	1,747,000	10,076	2,015,200
Salt herring,	38,350	8,633,800	74,097	16,894,116	46,918	10,697,304
Frozen herring,	27,752	5,550,400	22,825	4,565,000	19,940	3,988,000
Swordfish,	—	23,240	—	121,100	—	22,325
Cured fish,	—	4,754,370	—	3,436,608	—	2,553,600
Frozen squid,	—	—	—	—	—	100,000

CATCH OF GLOUCESTER VESSELS.	1905.		1904.		1903.	
	Barrels.	Pounds.	Barrels.	Pounds.	Barrels.	Pounds.
Porgies,	1,226	245,200	1,636	327,200	-	-
Halibut fns,	217	43,400	252	50,400	240	48,000
Whiting,	4,200	840,000	3,000	600,000	-	-
Shad,	-	8,000	330	66,000	-	-
Salt alewives,	-	-	1,000	200,000	-	-
Fresh alewives,	-	-	380	76,000	-	-
Fresh fish from boats,	-	900,000	-	600,000	-	1,750,000
Miscellaneous,	-	400,000	-	800,000	-	778,000
Total landed at Gloucester,	-	112,459,818	-	103,528,924	-	87,843,029
Total landed by Gloucester vessels at other ports direct (estimated),	-	44,650,000	-	31,776,000	-	36,900,000
Total landed at Gloucester and by Gloucester vessels at other ports,	-	157,109,818	-	135,304,924	-	124,743,029

Total Catch (in Pounds).

SPECIES.	1900.	1901.	1902.	1903.	1904.	1905.
Fresh cod,	34,051,392	35,972,524	36,373,316	30,557,215	30,635,979	36,137,281
Salt cod, ¹	-	-	-	-	-	-
Fresh haddock,	28,235,850	28,930,241	38,395,314	40,338,852	47,508,663	65,897,085
Fresh pollock,	5,277,824	2,193,800	12,579,588	3,308,510	7,984,292	20,409,516
Salt and cured haddock, ¹	-	-	-	-	-	-
Newfoundland frozen herring,	3,229,000	1,718,800	2,637,500	3,097,200	2,723,900	6,882,080
Newfoundland cured herring,	7,001,000	10,029,600	10,023,000	7,886,600	16,098,460	8,568,616
Salt ground fish,	51,128,896	47,319,664	52,980,480	43,049,216	49,296,240	49,221,200
Totals,	128,923,962	126,164,629	152,989,198	128,237,593	154,247,534	187,115,778

¹ Included with salt ground fish.

Methods of Marketing. — Up to the present the sea fish supply has been so abundant and readily accessible that comparatively little attention has been given to developing apparatus for capture, or to devising improved methods of handling for market. The market for quantity already exists, and the demand for quality is increasing. The call for improved technique in marketing fish is thriving. Mark the increase in special brands, in retail markets arranged with particular reference to cleanliness, attractive methods of display, etc. So, too, the wholesalers, the owners and the masters of vessels must prepare to meet this demand for quality, in addition to quantity.

Sails v. Power. — The first and most important feature, the reduction of time between the actual catching and the table of the consumer, is being met by the increased adoption of power boats. The romance of the fisheries is rapidly departing. The up-to-date Captains Courageous now no longer brave the storm in sail-driven boats, but escape the peril by the aid of power-driven craft. Not alone is human life safer (if proper precaution is observed concerning fire), but more regular connections can be made with daily express trains and steamers, by which the day's catch can be in the Boston or New York market in the morning following the catching. The longer time upon the fishing grounds means more fish. The better condition of the fish means higher prices. Less labor at the oars is necessary in case of unfavorable winds. And, finally, the year's total profit, barring accident, is certain to be a handsome excess over that of the sailing craft under identical conditions. Instances are not uncommon on our coast where a boat, when equipped with a suitable "auxiliary" engine and screw, has yielded an increased profit of \$5,000 or over.

In a similar way, as the power dory and the mastless power launches are replacing the picturesque sailing dories and "sprit-sails" for shore fishing, the fishing steamer is destined to drive out the beautiful schooner. But the same sturdy genius and courageous enterprise which has made the Massachusetts fishing schooner, with her yacht-like lines, the superior in speed and safety of all other fishing craft, still exist to make the Massachusetts fishing steamers safer for the crew, more productive

to the owners, and, by being more speedy in the dash for the market, give better service to the public.

With the building of larger and speedier vessels the importance of taking advantage of favorable market conditions is increased. The development of wireless telegraphy promises increased usefulness when it can be utilized to direct vessels to a favorable market. So, too, it may become possible by wireless telegraphy to acquaint other vessels of the presence or absence of fish or bait in definite localities, thus reducing the cruising expenses and increasing the number of trips possible during the season.

Yet it cannot fail to bring a pang of regret to lovers of the beautiful on the sea that the realm of romance should be thus invaded by the rampant spirit of utilitarianism, and to think that in a very few years the graceful fishing schooners of Massachusetts may meet the fate which is already overtaking the sailing craft of the Great Lakes.

The "Nautical Gazette" says:—

In spite of the fact that practically all steam crafts, even those in the lumber trade, are finding enough to keep them busy, there are dozens of schooners at ports on Lake Michigan which have not been under sail with a cargo this season. There are more which have made a trip or two since April, but most of them are now compelled to lie at their docks and dry out their seams under the rays of a torrid sun.

The day of the sailing craft as a factor in lake transportation has certainly passed, and complaints of dull times among their owners a year or two ago are doubled during the present season.

In former years the schooner found various means of employment, carrying alabaster, pig iron, slabs, pulp wood, cement and many other commodities, but they have none of these to fall back on now. The steamer has taken their place in practically all. There is some hope of the schooners having something to do later, but the prospect of their owners laying up a profit for the season is decidedly meager.

There is, however, little reason to believe that such a development in the fishing industry means decadence to the superbly daring seamanship of that hardy race which in our national life has contributed so notably of valor in war and of sturdy industry in peace; nor does it by any means follow that the wage-earning capacity of the crew should be diminished. It is but another instance of machinery replacing hand labor.

The almost universal economic experience is that such is, on the whole, beneficial. The doom of the fishermen is not yet!

It should be noted, however, that the conditions under which the market fishery is carried on in Massachusetts are not identical with those of the market fisheries as carried on in Germany or England. The more notable points of variance appear to be: (1) the ocean bottom, which may tend to make European methods of trawl fishing less satisfactory here; (2) on account of the greater speed of our fishing vessels and the proximity of our fishing grounds to the market, as compared, for example, with those of the North Sea, fishing steamers in the Massachusetts fresh fisheries would seem to have less advantage over sailing vessels than is the case in European waters.

The iron steam trawler "Spray," built upon the model of the Grimsby trawlers, went into commission early in December. She is the pioneer otter trawler in American waters. She was built by the Fore River Shipbuilding Company, and is owned by a local company organized by local capital. She is especially interesting as an example of the advanced type of fishing vessel and of fishery methods which long experience and a heavy market demand has evolved in other waters. The success of the otter trawling method in the New England fisheries may revolutionize the fishing industry on this side of the Atlantic as it has on the North Sea.

Apart from the difficulties necessarily connected with the application of new methods to new conditions, there appear certain advantages. Among others are: (1) the possibility of fishing in wind and sea when a dory could not live; (2) independence of bait supply, and fishing can be prosecuted day and night; (3) the risk of tending trawls and separation from the vessel is eliminated.

The discussion of the Hay-Bond treaty and of questions connected with it — *e.g.*, reciprocity, continental free trade, protection of the salt fish industry of Gloucester, the dependence of Massachusetts fishermen upon Newfoundland bait, the rumors of retaliatory measures, prohibition of fishing, seizure of vessels, raising a higher tariff wall against imported fish and fish products — have happily led to no inconsiderate actions. The events and the discussion of conditions have called atten-

tion to the reciprocal advantages of a minutely complete understanding of the problems. In a similar manner it has been demonstrated that present conditions are not altogether satisfactory. There have been times in the past three years when it would have been to the great financial advantage of Massachusetts vessels to be able to procure squid, herring and capelin in Newfoundland. So, too, there have been times when our vessels might have carried bait (*e.g.*, squid and sand-eels) or even several kinds of readily portable merchandise (*e.g.*, oil clothes, boots, shoes and rubbers, etc.) to Canada and Newfoundland, to advantage of the people of both countries. Obvious results of the defeat of the Hay-Bond treaty appear in the greater development of the bait fisheries of Massachusetts; the extension of cold-storage and freezing plants; the development along the Nova Scotia coast, notably at Canso, of cold-storage establishments, where squid and herring can be bought by vessels from all ports. Thus the keen business sense of the Nova Scotian merchants, aided by the wise consideration given to the development of the trade by the Canadian Department of Marine and Fisheries, seems likely to acquire much of the money formerly paid to the individual Newfoundland fishermen distributed in small groups along the southern and eastern shores of that island. Many of these fishermen have in years past each "baited" annually upwards of 10 "Yankee" vessels at \$40 per baiting; and the loss of this money falls heavily upon a people who have practically no other source of ready cash. Instances where our fishermen have lost an unusual amount of time or money through the curtailment of baiting privileges at Newfoundland harbors are very infrequent, and do not warrant serious consideration. Personal contact with the Newfoundland fisherman at his own home convinces us that an unduly heavy burden has been cast upon him, rather than upon the Massachusetts fishermen or upon the consumers of fish in the United States, as the Newfoundland government and merchants have hoped and expected.

Disasters. — As a direct result of the development of an improved type of larger and stancher fishing vessels (of which the "Grampus," designed by our honored late chairman, Captain Collins, was the pioneer), for two consecutive years not a

single fishing schooner has foundered, and no wrecks have been attended with loss of life. The deaths from exposure have been lessened from the development of the practice of supplying the dories with food and water, so that in the event of missing their vessel the men have an improved chance of being picked up or of rowing to land. With the increasing custom of fishing over wider areas, the loss from collisions has decreased. Of the total of 11 vessels destroyed, 3 were lost (all loaded and homeward bound) last winter while engaged in the Newfoundland frozen herring trade. The crew were saved; vessels and cargoes total loss. Schooner "Golden Hope" sprung a leak and sank off Bay of Islands, N. F.; schooner "Bessie M. Devine" went ashore and caught fire at Whitehead, N. S.; schooner "Edward A. Perkins" went ashore at Louisburg, Cape Breton. Three of the Gloucester banking fleet were also lost, but happily the crew were saved. Schooner "Hazel Oneita" went to pieces on a ledge off Cape Sable, N. S.; schooner "Puritan" mistayed and was a total loss on Stag Rocks, near Canso, N. S.; schooner "Columbia" run down and sunk by steamship "Sverra" off North Sydney, Cape Breton. Of the other 5, schooner "James Driner" struck on Romer Shoal; the gasoline boat "Columbia" burned off Block Island; schooner "Alice S. Hanks" caught fire from explosion of the binnacle lamp; schooner "Clara" sank off Point Judith; schooner "Veteran" sank off Wood Island, after going ashore off Cape Elizabeth, Me.

The total loss of life was 21, including 3 men drowned at the wharves while attempting to board their vessels, 6 who died on shipboard or in hospitals after landing, and 1 who was drowned in his dory as the result of an epileptic fit. Seven widows and 10 orphan children were left. The total value of vessels and outfit was \$74,350; insured for \$44,259.

High Liners of the Fleet. — The fishing year just closing has, all in all, been a successful one. Good catches have been made, and generally high prices realized. Some of the salt bank cod fishermen have made extra large season's works, and this in spite of the fact that they were denied the usual baiting privileges at Newfoundland. It is the opinion of the leading salt banking captains that they have done as well, if not

better, than if they had the privilege, and their bait bills have been less by many hundreds of dollars.

The high line of the salt bank fleet was the trawling schooner "Elector," Capt. Clayton Morrissey, who also held the honor last year and in other years. The "Elector" made two trips, starting in March and closing her season early in November. On her first trip she weighed off 291,000 pounds of salt cod, stocking \$9,735, the crew sharing \$225. On her second trip she weighed off 226,000 pounds of salt cod, stocking \$9,527, the crew sharing \$231.80. Thus for the season she landed 517,000 pounds of fish, stocked \$19,262, and the crew made \$456.80 each.

Another excellent record was that of schooner "Aloha," Capt. John McInnis, also in the trawl salt bank cod fishery. On her first trip she weighed off 183,000 pounds of salt cod, stocking \$5,623.56, the crew sharing \$92.79. On her second trip she landed the biggest fare of the season, 305,000 pounds of salt cod, stocking \$12,753.12, — the highest stock for the year for a trawling salt banker on a single trip, and also one of the best on record; the crew shared \$266.59. For the season the "Aloha" landed 488,000 pounds of salt cod, stocking \$18,376.68, the crew sharing \$359.38.

Another fine season's work was that of schooner "Independence II," Capt. Joseph V. Cusick, also in the trawl salt bank cod fishery. On her first trip she weighed off 281,000 pounds of salt cod, stocking \$8,864.35, the crew sharing \$151.07. On her second trip she weighed off 216,000 pounds, stocking \$9,249, the crew sharing \$171.76. Her catch for the season was 497,000 pounds, the stock \$18,113, and the share of each man \$322.83. The share was not so large in proportion as that made by some of the other crafts, because, where most of them carried 9 dories, or 20 men, this craft had 10 dories, or 22 men.

Schooner "Arbitrator," Capt. Wilson Spinney, also made a fine season's showing, and probably the best of any of the trawl salt bankers carrying 8 dories, or 18 men. On her first trip she weighed off 229,000 pounds of salt cod, stocking \$7,721.16, the crew sharing \$181. On the second trip she had 214,000 pounds of fish, stocking \$9,537.43, the crew shar-

ing \$242.42. For the season she landed 443,000 pounds of salt cod, stocking \$17,258.59, the crew sharing \$423.42.

The high line of the dory hand-lining salt bank fleet was schooner "J. J. Flaherty," Capt. Fred Le Blanc. On her first trip of the season this craft weighed off 151,000 pounds of salt cod, stocking \$5,500, and on the second trip she had 294,000 pounds, stocking \$12,960, — the largest stock on a single trip for the year for either trawlers or dory hand liners, and also one of the largest on record in the dory hand-line fishery. On this latter trip the high liner of the crew earned \$325. For the season the "Flaherty" landed 445,000 pounds of salt cod and stocked \$18,460.

Schooner "Gladiator," Capt. Joseph Spinney (his first trip as skipper), on a single trawl salt bank cod-fishing trip, weighed off 260,000 pounds of salt cod, stocking \$10,259, the crew sharing \$314.

Of the flitched halibut fleet, which fishes the far northern waters of Bocalieu Bank and Davis Strait, the schooner "Arbutus," Capt. Charles Fleggore, was high line. The vessel weighed off 90,208 pounds of flitched halibut and 34,830 pounds of salt cod, stocking \$7,517.92, the crew sharing \$182.92.

The leader of the Georges halibut fleet was schooner "Kineo," Capt. John Stream, which from April to October 20 stocked \$20,403, the crew sharing \$606.15 each. Captain Stream has been high line of this fleet for several seasons.

Schooner "Squanto" of Duxbury, Capt. Daniel McDonald of Gloucester, is credited with being high line of the bank halibut fleet, with a stock of \$22,000.

Schooner "Tacoma," Capt. Adelbert Nickerson, has also done well in this fishery, stocking a little over \$20,000.

Schooner "Agnes," Capt. James Goodwin, and "Cavalier," Capt. Robert Porper, have each stocked \$14,000 since April in the bank halibut fishery.

The attempt at seining codfish in the vicinity of Sable Island was made again this year. Schooner "Tattler," Capt. Alden Geel, and schooner "Emma E. Witherell," Capt. Thomas Benham, sailed from here April 6, the former returning July 1 and the latter June 25. Both fished with purse seines. The

"Tattler" had 376,000 pounds of salt fish and the latter 283,000 pounds. Unfortunately, but few codfish were found in the shoal water, where they generally school on the smooth sandy bottom, and the greater part of each fare was pollock.

One of the best stocks made in the fisheries for the year was that of schooner "Lucania," Capt. Martin L. Welch of Gloucester. This vessel engages in mackerel seining in summer and haddocking in winter. Since her first trip of the season, haddocking, Oct. 14, 1904, to the close of her seining season, Sept. 19, 1905, she made the big stock of \$39,030.33. Of this amount, \$18,879.79 was made mackerel seining and \$20,150.54 in haddocking.

Notable among those prosecuting the shore fisheries were:—

Schooner "Mary E. Cooney," Capt. Frank Cooney. From Jan. 1 to about Nov. 25, 1905: vessel's stock, \$28,864.34; crew's share, \$1,135.43.¹

Schooner "Beldino T. Domingoes," Capt. Manuel P. Domingoes. From Jan. 1 to about Nov. 25, 1905: vessel's stock, \$27,689; crew's share, \$1,069.49.

But the high liner of the entire Massachusetts fleet was schooner "Mary C. Santos" of Provincetown, Capt. Manuel D. Santos, with a gross stock of \$42,240.38, with 10 dories and a crew of 23 men. The crew's share was \$1,071, from Jan. 9 to Nov. 29, 1905.

In October immense schools of cod appeared off the Rips of Monomoy. In November these struck off the Chatham shore in such numbers that during November and December over \$50,000 worth of cod were taken by the Chatham people alone.

Similar conditions obtained at Provincetown.

Herring.—Herring, both fresh and salt, show a decided falling off in quantity and quality. The fall herring fishery both on Massachusetts shore and on the treaty shore of Newfoundland was a disappointment, on account of the scarcity of the fish.

In view of the value to Massachusetts of the Newfoundland herring fisheries, and in consequence of the lack of exact information here, with absence of reports which were certain to

¹ This vessel has made one trip since I received these figures, and stocked about \$2,000.
—W. W. NIXON.

be untinged by reflections of personal interests, Commissioners Field and Delano were delegated by His Excellency the Governor to make a personal investigation for the purpose of securing first-hand information upon the winter herring fisheries in Newfoundland, in the interests of the Massachusetts fishermen. The commissioners recognized the importance of the question, and the nature of the peculiar circumstances which led to the present delicate situation.

They left Boston September 26, and on the return left Bay of Islands, N. F., October 13, arriving in Boston October 18. Their observations are embodied in the following report:—

TO HIS EXCELLENCY WILLIAM L. DOUGLAS, Governor of the Commonwealth, State House, Boston, Mass.

SIR:— The chairman and Mr. John W. Delano, of the Massachusetts Department of Fisheries and Game, returned October 18 from Bay of Islands, St. Johns, N. F., and Sydney, Cape Breton. They have investigated the winter herring fisheries in Newfoundland, in the interests of the Massachusetts fishermen.

The conditions there have been extremely complicated; as a matter of fact, it is simply a game of chess. The purpose of the Newfoundland government is not alone retaliation for the rejection by the United States of the Hay-Bond treaty, excluding Newfoundland dried and salted fish from the United States ports, but is more directly for the purpose of controlling the Newfoundland fisheries in the interests of the Newfoundland merchants. If the Americans were not present as purchasers of fish, the product would be bought from the fishermen by the local merchants, and in general the fishermen would be paid in goods, or a small price in cash, somewhere from 65 cents to \$1.25 per barrel. These local merchants, in turn, would sell to the shipping merchants, chiefly in St. Johns, who control sailing and steam vessels, as well as the sealing and the Banks fishing fleet. There are very few instances in Newfoundland where fishermen own the whole or a part of the vessel, as is the case in the United States and Nova Scotia. The general outline in which the ministry is endeavoring to push out the Massachusetts and the Nova Scotian vessels is shown in the following quotation from the St. Johns "Evening Herald":—

A company will be formed with a capital of \$100,000, in \$50 shares, to be open to the public, every business man in the city contributing, but restricted to one-quarter of the entire capital. Vessels will be hired, our excellent banking fleet given the preference, and the winter herring fishery, both bulk, salted and fresh, will be conducted at the Bay of Islands, and the prices paid equal to any ever given by Americans, while the cargoes will be marketed at Boston and vicinity.

The government have been asked to enforce the act stringently, see that Americans conform to our fishery rules, and give them no opportunity to land; at the same time prevent our own people selling to them, no matter what inducements are held out. The company ask in return a small bounty, equivalent to 50 per cent.

of duty paid on herring entering United States ports. This, it is thought, will enable our people to compete with the Yankees, and in fact prevent anything like the cargoes they have had in the past being obtained. Those interested request the government to do this for one year only, believing that it will more rapidly bring the Americans to their senses than anything else ever attempted. When the project was laid before members of the Executive by A. F. Goodridge, Esq., chairman, Hon. John Harvey, secretary, and the committee, the government asked for time, and have meanwhile wired Sir Robert Bond respecting the proposition, and are awaiting his reply. Until the promoters have received a definite answer, there can be no attempt to carry it to a conclusion. The idea appears to be a commendable one, and it will at least mean the distribution of a large sum of money among our fishermen, that, in the event of the law being enforced, without such would be lost to them and the revenue. The promoters fully realize what can be done, and those who were opposed to the Hay-Bond convention and the fisheries act of this year are now favorably impressed with this scheme, and, whether supporters or opposed to the government, are willing to help all in their power. If this is done, it will conclusively prove to banking owners they are just as able to conduct the herring fishery as our American friends; and, instead of having their craft lying up in November and December, can utilize them profitably in this work. It will strengthen the hands of the government, and all that is needed is another steamer with the "Fiona" to protect our people and carry out the law. The duty on herring going into the States in foreign bottoms is $\frac{3}{4}$ of a cent. per pound on salt, and 1 on fresh; while it is estimated a capital of say \$20,000 will be ample to carry out the business.

From the Newfoundland point of view it is rather a question of trade and of local politics, *i.e.*, the government and the merchants *v.* the fishermen, than the broader question involved in the Hay-Bond treaty, though each move of the "Yankee" is carefully watched, and a corresponding move to checkmate is prepared.

The attitude of the fishermen can best be understood from the statements made to us, of which the following is a fair example:—

Up to this past summer we have been selling bait to 10 or 12 vessels which have come to us regularly every year. We receive \$40 cash for baiting each American vessel. This means from \$400 to \$500 every summer. During the past summer, however, no American vessels have been in for bait. The result is, we have had the bait on hand, and have been obliged to throw it away. This means a direct loss of \$400 or \$500 to every family in this harbor.

This same condition obtains all along the south, east and west coasts of Newfoundland. The recent decision by the Newfoundland ministry, that the fall and winter herring fisheries were included in the bait restrictions, was received with feelings of dismay by the individual fishermen on the treaty coast, notably at Bay St. Georges, Bonne Bay and the Bay of Islands. At the latter place the feeling is unusually strong, for the reason that the Nova Scotian and the Massachusetts fishing vessels have annually left in the hands of the fishermen, as a price of the herring and other supplies bought, not less than \$100,000 in cash. The Bay of Islands is a series of advantageously located fishing hamlets, where the herring are caught in October and November within a cable's length of the fishermen's homes. The quantities are incredible, and a vessel may be loaded in a very few days, so that this \$100,000 or more becomes available within six or eight weeks after the herring strike.

The state of mind of the fishermen can best be gathered from the following quotations, from the "Western Star," published at the Bay of Islands October 11:—

Despite public and private agitation of the suspension of the bait act against Americans, the government still remain firm in their intentions to strictly enforce the law during the fall and winter herring fishery in Bay of Islands. The "Star" has endeavored to plainly state the position in which our fishermen are, and we have also pointed out the futility of enforcing the bait act. But no amount of persuasion seems to reach the heart of the government; and now our fishermen must console themselves with the knowledge that the herring fishery this season will not be prosecuted as formerly. They have been hoping against hope, with the expectation that the powers that be would see the wisdom of taking advantage of the suspending clause, and thus allow American vessels to secure cargoes in the same manner they have in years past. But no; our men must sit idly on the banks of the Humber, and watch the Americans taking herring from their doors. The fishermen say they are not going to allow this state of affairs to exist; for if the Americans are allowed to take their own herring, which they claim to have a right to do according to the treaty of 1818, and if they are willing to purchase from our men, they (the fishermen) contend that they are entitled to a share of the spoils. Two vessels are now in port, supplied with salt and nets, and have come prepared to do their own fishing, if our men are prohibited from fishing for them; and we learn that a great many vessels are fitting out at Gloucester to come here.

Our fishermen have become so indignant over this fishery question that a mass meeting of over 300 men was held Monday night in the C. E. Institute. The place was literally packed, and over a hundred were unable to gain admission. Mr. James Barry was called to the chair, and Mr. A. L. Barrett was chosen secretary. A free discussion took place, and every speaker expressed himself highly indignant with the government for keeping in force the bait act. A committee of 12 was appointed, and the following memorial was drawn up, which was telegraphed to His Excellency the Governor yesterday morning:—

"We, the fishermen of Bay of Islands, and others directly interested in the fall and winter herring fishery, at mass meeting assembled, do hereby memorialize that His Excellency the Governor in Council put in force the suspending clause as provided in the foreign fishing vessels act passed by the Legislature last spring.

"We do also protest against the request advanced by the merchants of St. Johns, as it would, in our opinion, put a premium on monopoly, and in the mean time does not safeguard our interests.

"We do further declare that the situation as at present is an outrage against those whom it should benefit; inasmuch that we are prevented from selling our herring to the Americans, while in the mean time Americans can come and catch herring themselves.

"If our requests are not granted immediately, we shall be compelled, in justice to ourselves and families, to seek other ways and means to engage with Americans.

"We would also direct the attention of His Excellency the Governor in Council to what took place in Fortune Bay a few years ago, when Capt. Solomon Jacobs seined herring against the wishes of the people, and the result. If a similar occurrence should take place here, who will be responsible?

"Whereas, In times past we have been ignored in our requests by the Colonial Government; we do hereby

"Resolve, That this memorial be telegraphed direct to His Excellency the Governor, trusting the same will be placed before his ministers without delay.

"We respectfully solicit an early answer, to avoid further trouble."

There are involved two distinct phases: (1) the Newfoundland government seeks to prevent off-islanders from buying herring and

bait, for the ultimate purpose of (2) controlling the fisheries industries with Newfoundland capital, through the agency of its own population and vessels.

It is a fact that Massachusetts and Nova Scotian vessels have in the past hired the Newfoundland fishermen on the treaty coast to assist in catching and freezing the herring. This, from the Newfoundlander point of view, is tantamount to buying the herring, except in the one case the captains buy the time and labor, and in the other they buy the products of that time and labor.

We could find no grounds for the statement "that the 'Fiona's' commander has strict orders to seize any American vessel fishing in the Bay of Islands," and are of the opinion that such orders have not been given. On the contrary, we believe that the Newfoundland authorities are acting for what they believe to be the interests of Newfoundland as a whole, and hope to secure a wider market for the Newfoundland fisheries. The issue is distinctly and alone upon the question of markets, and how the trade shall be carried on, not upon the question of the rights of fishing under the treaty of 1818. The Newfoundland authorities seek to compel Newfoundland fishermen to deal with Newfoundland merchants, instead of selling direct to Massachusetts and Nova Scotian vessels. The St. Johns, N. F., "Telegram," October 10, says:—

Two American schooners are here [Bonne Bay, N. F.], and both will respect the treaty, and are prepared to catch their own herring. Fishermen sent message to government this morning to explain their attitude. They seem determined to fish and sell herring, even if they have to take forcible possession of the American schooners to do so.

There can be no question that the bait act at present is far greater hardship to the Newfoundland fishermen than to the Massachusetts fishing vessels; while the refusal of the Newfoundland authorities to permit the purchase or sale of herring, or the hiring of Newfoundland fishermen to catch herring, or to assist Massachusetts crews in catching herring, falls with greater severity especially upon the communities at St. Georges Bay, Bonne Bay and Bay of Islands, whether the proposed Newfoundland company for shipping fish materializes or not.

The Massachusetts commissioners had a conference at North Sydney, October 14, with the captains of the Massachusetts vessels in the harbor, bound for Bay of Islands, and gave them the above information, at the same time advising that vessels come equipped with men and gear sufficient to catch fish without depending upon landing or upon the Newfoundlanders for fish or assistance. We also gave our opinion that it might be possible to ship men legally outside the three-mile limit, and thus evade the local regulations; but we strongly advised against such action, until this point had been ruled upon by the United States or English authorities. In spite of all the rumors of a demand for a Newfoundland license, and of seizure if such license were not procured, it did not appear possible to your commissioners for the Newfoundland authorities to nullify the rights actually guaranteed by the treaty, or to make any local regulations which would tend to do so. There is no evidence that the Newfoundland authorities contemplate the prohibition of fishing by

Massachusetts vessels; but the intention is to draw the lines strictly to the guaranteed rights, *i.e.*, to enter harbors, bays, etc., to *catch* fish, and for the purpose of shelter, of repairing damage, or purchasing wood and obtaining water, *and for no other purpose whatever*.

The captains and crews expressed the opinion that all Massachusetts fishermen intended to respect the local laws and regulations to the letter while in Newfoundland waters. The following, from the Sydney "Daily Post," October 14, is a tribute to the fishermen:—

For the past week there have been between 75 and 100 fishing vessels anchored in the harbor, hailing principally from Gloucester and Nova Scotian ports. These floating homes contain in the vicinity of a thousand men, and a more law-abiding community it would be hard to find. Fishermen, when they get ashore, according to the general idea, are invariably prone to getting drunk and creating a disturbance, eventually landing in jail. The custodians of the peace have but five arrests to report in their seven days' watch on the movements of this transient population.

Still, the question is a complex one, and the next move on the chess board may bring in unforeseen complications. It is our opinion that, if the Newfoundland fishermen are not permitted to sell their herring, they will interfere with Nova Scotian and "Yankee" vessels catching herring in their own "front yards," so to speak; and seines may be destroyed under cover of darkness, in spite of the good offices of the "Fiona" and of the able representative of the State department and of the United States Bureau of Fisheries, Mr. A. B. Alexander, who is now at Bay of Islands. Realizing this, the captains of the fishing vessels at Sydney have drawn up a petition to the proper British authorities asking that a war vessel may be stationed at the Bay of Islands during the months of November and December. They recognize, of course, that the search lights are all that are necessary to preserve the peace.

At Halifax we had the privilege of meeting the Honorable, the Minister of Marine and Fisheries of Canada, and of asking his consideration of the expediency of stationing a British cruiser at the Bay of Islands during the winter herring season.

At the request of the Hon. Elihu Root, Secretary of State, we are forwarding to him a copy of this report.

Respectfully submitted,

GEORGE W. FIELD,
Chairman.

Cod.—The bank cod fishing fleet left about April 1. The denial of fishing privileges in Newfoundland waters other than those of the treaty coast, under the *modus vivendi* license system, caused some inconvenience to those who came unprepared with bait seines for catching their own bait. On receipt of the news, capelin nets were shipped to Nova Scotian ports, where they were put on board the vessels.

The early bank fleet therefore were somewhat delayed by failure to seine bait on the south and east coast of Newfound-



Fish houses and "flakes," Cape Broyle, Newfoundland.



"Toads Cove," a typical shore fishing village, Newfoundland.



A Newfoundland harbor.



Gloucester fishing vessels in Bay of Islands, Newfoundland,
for fall herring.

land, while the ice prevented access to the treaty coast and to the Magdalen Islands, where bait could be procured. It has become a custom for our banking vessels to call at Newfoundland ports to buy bait and to ship men. There were advantages to both parties. But it has proved that Newfoundland bait is by no means essential to Americans; on the contrary, it was a distinct advantage to us to be compelled to develop our own baiting facilities, and generally speaking abundant bait supplies were secured at a considerably less price than had previously been paid to the Newfoundland fishermen. This experience has led to such a development of our own baiting facilities that in the future we should be able under ordinary circumstances to provide for the baiting of the Massachusetts fleet, and in favorable bait seasons to sell bait to our less fortunate neighbors.

Though the general tone of the market has been at times unsatisfactory, particularly in the case of the Grand Banks fleet and of the mackerel seiners, the shore cod fisheries have been remarkably good, and prices both for fresh and salt fish have ruled very high, even to such a degree that upwards of 600,000 pounds of salted cod have come to our Boston market from the Pacific, and in addition an increased quantity of halibut has come to the Boston market by refrigerator cars from Vancouver.

On April 15, steamer "A. B. Nickerson" seined 40,000 pounds of cod off Wood End, Provincetown. This is claimed to be the largest lot ever taken in those waters with seines.

Similar reports of unusually good catches come from all the Rip fishing grounds on the Massachusetts shores, especially in the autumn. This strike came too late to be figured in the returns given in Appendix G. The great relative abundance of cod and other non-migratory fish close to our shores seems to point clearly to the success of the methods adopted by the United States Bureau of Fisheries, and to the practical value of the two United States fish hatcheries on the Massachusetts coast at Woods Hole and Gloucester. During the past year billions of cod fry have been hatched from eggs which would otherwise have been destroyed or been of slight practical market value. These fry from these eggs have been planted off our shores.

Here seems to be the logical method of dealing with our fisheries. Depletion of the fishings, either local or general (or with some species both), is certain to follow as a result of increased demand, when the fishing methods are notoriously unwise, as in the case of the lobster at present. The true solution lies not in limiting the demand through prohibition of the use of certain apparatus, nets, traps, beam and otter trawls, etc., or of particular methods of fishing, but rather in developing methods likely to secure an increased supply of fish, such as artificial propagation, and the prohibition of fishing in certain areas where normal breeding may go on undisturbed by man. It would be exactly as logical to forbid the use of machines for planting and digging potatoes or other agricultural produce, or to forbid the use of cattle as food, or as a source of leather, etc., because the natural supply has become curtailed by human requirements. The true economic solution is the protection of the necessary number of breeding adults, to ensure an adequate supply of eggs, and the protection of the young up to a marketable size. The problem on land and sea is similar. Marine farming and grazing are coming necessities. The possibilities of development of animal food in the water is far greater than upon land. The only difference is, that on land our ancestors long ago met and conquered the difficulty. The next generation may be compelled to solve this problem of marine farming and grazing. We, as a race, are not familiar with the details of the first and greatest struggle in the development of agricultural methods by our forefathers, and therefore hesitate to attack the more novel but ultimately more profitable cultivation of the sea and its shores.

Mackerel. — The exceptionally warm weather of March aroused hope that the southern mackerel trip, a lottery at best, might this year furnish improved chances. By the last of March steamers reported large schools of mackerel off Hatteras. During early April the fleet were obliged by gales to seek harbor inside the Capes of Virginia, so that during the month of April few mackerel reached the market. One seiner landed 2,100 large, fresh mackerel, averaging about 2 pounds each, at New York, about April 26, which sold at 50 cents each in New York and 65 cents in Boston.

The first mackerel from Massachusetts waters to arrive in Boston came from Chatham, on or about April 26, — a single specimen.

The catch of the New England fleet up to April 29 was 61 barrels, against 865 barrels in 1904, 8,331 barrels in 1903, 14,227 barrels in 1902, and 5,496 barrels in 1901.

Early in April the great school of fish appear with unfailing regularity off the Capes of Virginia. In this neighborhood they usually remain for three to five weeks, then practically disappear, to strike again off Fire Island, N. Y., where they usually remain perhaps two weeks. By the middle of May a large school may be expected off Block Island, and another large school passes eastward and strikes off the southern Nova Scotia coast. During May the best fishing is usually off Block Island and on Georges Bank, frequently extending inland to the shores of Cape Cod. Many of the seiners, in addition to the supply of ice necessary for running the fish fresh to market, carry salt and provisions, so that the fish may be shipped to Boston or New York from Newport, Woods Hole or Provincetown without the necessity of a stop to refit.

The following clipping from the Boston "Globe," August 18, well indicates the method of fishing during the summer, when the mackerel are off the coast: —

Woods Hole, August 17. The mackerel fishing boats, about 50 in number, that have been tied up here for the past two days on account of bad weather, got under way this morning for the fishing grounds.

The fishermen report the mackerel in big schools in the sound and off No Man's Land, and believe that the season will be one of the best for many years.

The fishermen from all along the bay shore and from the towns of the lower Cape and Provincetown and Wellfleet have joined the fleet here during the past week, and they are having the best luck for many years.

On Monday, which was the last day that the little catboats could stand the weather on the fishing grounds, several seiners put in their appearance, and the fishermen say that they are afraid the seiners will scare the fish, and that small boats will not get such big fares. In any event, the fishermen say that there are mackerel enough for all this year, and they are a happy lot.

They make daily runs to and from the fishing grounds, landing at the dock here, where Capt. John Nagle, well known all along the Atlantic coast among the fishing fleet, takes them and prepares them for market.

In this way the fishermen are able to land their fares early in the evening, then turn in and get a little sleep before they start out for the fishing grounds at 3 in the morning.

Sixty-eight barrels were landed here one day last week. This was the record for one day thus far this season, but the best fishing days are yet to come, so the fishermen say, and they expect that the record will be no less than 200 barrels, or even twice that number if they get a whole day of good weather. Many of the catboats have power in them, and these make quick time to and from the fishing grounds, regardless of the weather conditions.

"Dave Nickerson," who was high line two years ago, and who came near being lost in the ice pack last winter off Monomoy Point, the life savers at great peril rescuing him from his little yacht, is here; also Capt. Walker Harding of Wellfleet, formerly a surfman at Cahoon's Hollow United States life-saving station.

The fishermen here are all expert mackerel catchers, and their opinion as to the season's catch is that it will be one of the best for many years. Capt. Harry Curry of Monument Beach is also with the fleet here.

On June 28, 29,000 mackerel, a record-breaking number, were landed at Newport, R. I., by the auxiliary schooners "Salada" and "Mary Z. Harty," both of Gloucester. The "Salada" brought 14,000 and the "Harty" 15,000.

The high liner of the mackerel seining fleet was Capt. Thaddeus Morgan of the schooner "Constellation," who completed his season's work September 21. His vessel stocked the magnificent total of \$38,000, and the crew's share per man was \$785.68. These are both seining records of the season. These records have been excelled but once in the history of Massachusetts mackerel seining, when Capt. Solomon Jacobs set the high-water mark by stocking over \$40,000.

As a whole, both the years 1904 and 1905 have been lean years for our mackerel fishermen. The comparative totals are given below. The price has averaged higher than last year. A larger number of vessels have participated in the catch, and there has been a more equal division than in former years. While the year has been a disappointing one to the netters, the Cape shore salt catch was the largest for years. There was a large showing of mackerel on Georges, but it was reported that very few schools were stopped. All along the shore large quantities of "tinkers" appeared, which the fishermen believe to be a favorable prophecy for next season's catch. Thus we may hope that 1906 may furnish a full season's catch, and that it may not be necessary for so many of our best men and

vessels to abandon the mackerel fisheries early in September, as was the case this year, on account of poor fishing.

The aggregate catch of mackerel in North American waters for the past six years is as follows:—

Total Catch of Mackerel in North American Waters, in Pounds, for the Years 1900-05, inclusive.

	1900.		1901.	
	Salt.	Fresh.	Salt.	Fresh.
United States,	17,593,400	9,885,600	13,478,200	10,417,200
Canada,	14,087,200	5,475,800	13,789,800	4,089,200
	1902.		1903.	
	Salt.	Fresh.	Salt.	Fresh.
United States,	9,106,800	13,756,200	8,878,400	14,129,200
Canada,	6,948,400	3,535,800	12,959,800	7,470,200
	1904.		1905.	
	Salt.	Fresh.	Salt.	Fresh.
United States,	5,794,600	9,360,400	5,818,000	9,980,400
Canada,	2,400,000	1,201,800	2,240,000	1,752,600

Total catch of fresh and salt mackerel, 204,149,000 pounds, divided as follows: New England fleet, 128,198,400 pounds; Canadian fleet, 75,950,600 pounds.

It is worthy of serious consideration whether or not the supply of mackerel is declining.

In general terms it seems unlikely, for the reason that the total catch in the relatively small section of the vast oceans inhabited by this swiftly migratory fish must be inconsiderable, when compared with the total number of individuals. In case of the mackerel, we are dealing with a fish which traverses practically every part of the North Atlantic, — not one

which is distributed over a limited area, as is the fact with the lobster; nor are we lying in wait for a species which resorts annually to special, well-defined and readily accessible breeding places, as do the shad, salmon and alewives, where the adults just at the time of egg laying are captured in great numbers for market.

Nevertheless, the catching of adult breeding fish wherever found, and the young "tinkers" in the fall of any size whatever, by the combined American and European fleets, must in time cause the inevitable decline. If it has not already appeared, it is due to the vastness of the ocean and the countless numbers of the mackerel.

Halibut. — For the past few years the Boston market has depended almost entirely upon the Pacific fresh halibut supply. The Atlantic halibut fleet has greatly diminished. This year the smallest fresh halibut fleet for many years brought to market 2,324,700 pounds, — an increase of 400,000 pounds over last year.

The fitched halibut fleet did poorly. From a fleet of nearly 70 sail and an annual catch of upwards of 20,000,000 pounds, the Massachusetts halibut fleet has dwindled to 12 or 14 vessels and about one-tenth of the former catch. The cost and hazard incident to bringing fish from these far-distant fishing grounds is too great to meet the competition resulting from the proximity of the Pacific halibut banks to the railroad termini on the Pacific coast. The abundance of fish and improved methods of transportation and refrigeration have won the market.

Pollock. — The pollock catch has been the best on record. Though the banner trips have been made during the autumn fare, from September to December, these fish were reported in great abundance in the early spring. The following report from Provincetown indicates the conditions there during April: —

Provincetown, April 17. Nearly 500,000 pounds of pollock have been taken in Provincetown harbor during the last five days. Boston's fresh pollock market has been glutted by the catch. During the past three days the fish have appeared along the entire harbor front, and seem increasing in numbers.

It is a source of great surprise that so few inland fishermen, who enjoy the song of the reel, should be ignorant of the gamy strength, active nature and fighting courage of the pollock. There is no more certain chance for sport than fishing for pollock at Provincetown with rod and reel. The general public have no conception of the enormous quantities of pollock which have been either marketed fresh in Boston or landed at Gloucester for salt curing. Upwards of 60 sail were occupied during the months of September, October, November and December, each vessel making two or three trips a week.

It is reported that the cook on one of these crafts "made \$500 since the latter part of September." Another report has it that the "crew of another vessel have averaged \$35 each per week since we started in the latter part of September, and have been home two or three times a week;" and "that ain't so bad."

Whiting. — There are decided evidences that this fish is gaining ground in the market.

Inspection of Fish. — There have been no requests during the past year for the inspection of fish, under chapter 138, Acts of 1902, and no fees have been received.

Dogfish. — An extended report upon the damage done to our fisheries by dogfish is to be found on pp. 95–169.

Seaweeds. — Large possibilities in the development of vegetable sea foods exist on the Massachusetts coast. At present attention is given to but two species, Irish moss (*Chondra crispus*) and dulse.

The methods of securing Irish moss are destructive to such an extent that some of the rocks are almost completely denuded. The Irish moss fisheries at Scituate are capable of great improvement. The season for gathering extends from May to September. If the gathering should be regulated with reference to the spawning season of the plant, the supply might be increased, and the fishermen thus be able to secure a larger quantity per day. The crop of 1903 was valued at \$31,050.

Dulse is considerably prized by our foreign-born citizens from the south shores of Europe, and is generally on sale in the fruit stores.

Dr. H. M. Smith of the United States Bureau of Fisheries,

who has studied the seaweed industries of Japan, has called attention to the fact that species similar to those utilized in Japan to the extent of \$2,000,000 worth annually are abundantly growing wild and neglected in the shallow waters of our bays. Under Japanese methods certain species of these plants make delicious salads, other species yield valuable jellies, while others are useful as condiments. An experimental study, to develop methods for utilizing this source of wealth, should be instituted in Massachusetts, where, from Dr. Smith's observations, the possibilities are at least equal and perhaps superior to those in Japan.

The Powder Hole Reservation.—In accordance with Resolves of 1905, chapter 54, the commissioners took "full control of the Powder Hole, so called, at Monomoy Point in the town of Chatham." The description and statement was duly filed Nov. 27, 1905, and recorded in the registry of deeds at Barnstable.

Previous to this taking, we made observations and experiments which appeared to indicate the great value of this special locality, on account of its adaptability for the study of the natural history of the lobster, clam, quahaug, scallop, oyster and winkle, all of great economic value to the people of this Commonwealth, either directly as food or as bait for the sea and shore fisheries of this region.

Capt. George W. Bloomer of Chatham was placed in responsible charge of this Powder Hole reservation; and with the active interest and co-operation of the other fishermen and residents we hope for large results, which will benefit not alone the residents of that section of Cape Cod, but through them the general public.

The definite purpose of the work there is to devise a commercially practicable method of rearing lobsters to a marketable size. Fortunately, also, favorable opportunity appears here to study the habits and life history of the scallop, with a view to the possible rehabilitation of this declining industry, which in past years has brought large amounts of money to the towns on the South Shore of Cape Cod.

The clam flats are well adapted for the growth of both the long clam (*Mya arenaria*) and in places also the sea clam

(*Mactra solidissima*), and thus offer special opportunities to study both these animals and their enemies. The quahaug or "little neck" (*Venus mercenaria*) can also be reared. Thus the natural conditions are unusually propitious for the study of methods for increasing the annual yield of these animals. As the advantages and importance of the work become known to the people of those localities, the heartiest sympathy and co-operation will develop.

During the spring and summer of 1905, 267 egg-bearing lobsters were placed in the Powder Hole. More than 4,000,000 young lobsters were hatched from their eggs. During the hatching period we found in the immediate neighborhood of the hatchery that the water was swarming with just-hatched lobsters, at the rate of 6 to each cubic foot of water. The lobsters were rapidly scattered by currents, so that cannibalism was prevented. Between July and November, 1905, 642 green egg lobsters and 98 male lobsters were put in. These were supplied with food. It is expected that these lobsters will safely pass the winter here in the 20 feet of water. Should this prove to be the fact, we shall turn attention to some method of controlling the ravages of such fish as we find preying upon the young lobsters; and, with the control of the enemies of the lobsterlings, a practical commercial method of rearing young lobsters may be possible.

The Lobster Fishery. — A discussion of the decline of the lobster industry, its causes, and a probable remedy based upon biological experience, is given at length on pp. 171–214.

The Shellfish Industries. — Almost the entire Massachusetts coast formerly had extensive and very valuable mollusk fisheries. Our location is fortunate, since zoölogically our coast is the point where the habitats of the northern clam (the soft clam, *Mya arenaria*) and of the southern clam (the quahaug, hard clam or little neck, *Venus mercenaria*) overlap. On our coasts the area between tide marks was formerly inhabited by huge quantities of soft clams, and the muddy patches just below low-water mark produced great numbers of quahaugs. In the estuaries of our rivers and creeks were extensive native oyster beds. On our shoals it was possible to gather hundreds of thousands of bushels of scallops. To-day all is changed. In

a few places it is still possible to get a relatively few clams and quahaugs. The scanty yield of scallops will not exceed 30,000 gallons. The natural oyster beds have all but disappeared, either "fished out" or buried under the débris of civilization. The total yield of the shellfisheries is valued at close to \$500,000 annually. Yet the areas can again be made to produce the normal yield. The value of the annual catch should be increased tenfold, and incidentally furnish increased opportunities for labor, for coopers, tinsmiths and other artisans, for transportation companies, and so on all along the line. Again, like the Pilgrims at Plymouth, we may "suck the abundance of the seas" and find health and wealth.

The opportunities for development are alluring. The conditions parallel those of agriculture, except that in case of marine farming the crops are more certain, *i.e.*, are not subject to so many fatalities. The money value of the crop per acre is only equalled by the results of the most intensive farming. Net profits of \$500 to \$1,000 per acre are frequent. The capital required is small. The skill required to guide and to assist nature is slight. The labor is practically limited to the harvest.

That we are not to-day securing the maximum yield of the areas suitable for growing shellfish is due to the increased demand, which has led to unsystematic digging of clams and the destruction of seed scallops. Pollution of the flats has led to destruction of much spat which is smothered in the slimy sludge of sewage. The *present laws* have placed the mollusk fisheries completely in the hands of the Philistines of town government. Petty local jealousies, unsystematic tenure and uncertainty as to private and public rights have prevented the development of private enterprise. By the system of town control we have escaped neither the dangers of monopoly nor of continued depletion of the supply, while the facts concerning the public ownership of the shellfisheries are in danger of becoming obscured.

During the past summer the commissioners have begun a series of experiments to determine the most practical methods of increasing the yield of shellfish under different conditions of tides and currents, soils, etc., and also facts in the life history of the edible mollusks, in order that by complete knowl-

edge we may better take advantage of natural processes. Massachusetts, by natural conditions of its coast, its markets as great centers of food distribution, and its large number of summer residents, is peculiarly fortunate. Practically limitless quantities of shellfish can be profitably handled.

During the past season the work has been laid out for the next two years. The following statements are but preliminary to the complete report.

The work upon the food mollusks has been carried on under the general direction of the chairman, and immediately in charge of Prof. James L. Kellogg of Williams College, perhaps the best authority on this continent upon the clam and oyster. The work has been carried on, with great credit to himself and to the satisfaction of all, by the biologist to the commission, D. L. Belding, A.B., assisted by Mr. R. L. Buffum and others. Mr. Belding's report follows: —

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—I herewith submit my report for the year 1905, as follows:—

Since I began work as biologist for the commission, June 26, I have devoted my time, with the exception of two weeks, entirely to the investigation of the shellfish of Massachusetts. These two weeks were spent in examining the conditions of certain fresh-water ponds, in response to petitions requesting the commission to stock them.

The necessity of improving our shellfisheries has become at the present day a matter of great moment. This has been brought about chiefly by the increasing scarcity of our once abundant supply.

For the first time in its history the Commission on Fisheries and Game has received appropriations for the investigation of edible shellfish. For some reason the shellfisheries have been totally neglected from a scientific point of view, and very little investigation has previously been conducted. This is especially true of the clam, quahog, and scallop. As the oyster has received a fair share of attention, my work this summer has been confined chiefly to the three former.

The experiments undertaken are for the most part of a preliminary nature, and especially devoted to the biological investigation of the life history and growth of these shellfish, as only from a thorough and complete knowledge of the life of these bivalves can results tending towards the improvement of the shellfisheries be obtained.

A handicap to the work, which became more apparent as the summer progressed, was the lack of a laboratory. At least a temporary laboratory is essential to a systematic observation of many details in the life history of these shellfish.

CLAMS.

It is hard to realize that the flats of this Commonwealth, once so thickly set with the soft-shelled clam (*Mya arenaria*), are rapidly becoming barren; but statistics in our clam fisheries show a decided decrease in production. There can be no doubt that wasteful exploiting by man has been the chief cause of the destruction of our clam flats. The clam flats of Essex furnish an example of this. Large portions of these, once bearing immense numbers of clams, now lie unproductive, and yet the conditions appear just as favorable for the growth of clams as in former days. The result of this decrease has thrown many hundred clambers out of business and now our future clam supply, both as food and bait, is seriously threatened.

The plan of the clam experiments conducted by the commission the past year is based upon three main objects:—

1. In the first place, experiments have been made to determine the rate of growth of the clam. Two important questions are considered under this head: (*a*) How soon can a marketable clam be produced? (*b*) What are the causes influencing the rate of growth, and the conditions that cause this rate to vary?

2. The second object of these experiments is a commercial one, including all parts which relate to the practical side of clam culture. Artificial clam beds have been planted, both on productive and barren flats, the size of the beds being based on an acre as the standard. The amount of small clams planted was measured in terms of quarts, and the yield estimated by the same standard. The chief object of this side of the work is to conclusively demonstrate that methods of successful clam culture are easier than oyster culture, and that by assisting nature the yield of the clam flats can be greatly increased and that profitable clam farming can be conducted. In following out this line the average and the maximum production per acre under different conditions are being determined by experiments.

3. The third object of these experiments is to ascertain the actual yield of the clam flats of Massachusetts. The reasons for scattering our experiments along the coast are: (*a*) the average yield of the whole coast could thus be determined; (*b*) a comparison of the rate of clam growth in different sections of the coast could be made; (*c*) all localities which produced clams could share alike, as it was not desired to confine all our experiments to any one town in particular, to the neglect of others.

Method of Work.

I. *Protection of Beds.*—To insure the success of the experiments, it was found necessary to have some means of protection from the encroachment of clambers. Although it was almost impossible to keep careful guard of all the beds, as they were scattered along the coast, the following methods were used, with fairly favorable results:—

1. Printed notices were posted on the beds.

2. The experimental beds wherever possible were situated under the direct observation of certain gentlemen interested in their success.

3. In a few cases the method of covering the surface with wire netting, securely fastened in the sand with long wire staples, was used. This did not interfere in the least with the growth of the clams, and made digging impossible, furnishing absolute proof whether or not the bed had been disturbed.

II. *Location of Experiments.*—Artificial beds have been planted at Dartmouth (Slocum's River), Onset, Monument Beach, Woods Hole, Harwichport, Nantucket, Chatham, Monomoy Point, Provincetown, Gloucester, Essex and Wheeler's Point (Annisquam River). Sixty experimental beds have been prepared, and are under observation.

III. *Size of Clam Beds.*—Two sizes of beds have been planted: (1) $\frac{1}{100}$ of an acre, or 435 square feet; (2) $\frac{1}{1000}$ of an acre, or $43\frac{1}{2}$ square feet. The reason for these sizes was to keep all records in terms of an acre for the practical side of the experiment, and also because these were the most convenient sizes for computations.

The method used to fix the location of these beds consisted of a double set of posts, one set sunk level with the surface, the other 4 to 5 feet high. The ranges of the bed were then taken. The precaution of a double set of posts was made in case the ice took away the high posts, for the sunken posts could be located by the ranges, and thereby the boundaries of the bed found.

IV. *Seed Clams.*—The clams planted varied in size from an inch to an inch and a quarter. Measurements of these were made as follows: (1) length of shell; (2) average number per quart; (3) number of quarts planted; (4) a table of volumetric displacement of different sized clams was made. In making this, large quantities have to be considered because of the error caused by the residual water in the clam. The clams for planting were usually obtained near the bed, although in a few cases they had to be brought from distant points. Careful account of the amount of seed clams and of the time required to obtain these has been kept; also, how they were kept, and their condition when planted.

V. *Clearing the Bed.*—The most tedious part of the work was taking from the bed, before planting, the clams which were naturally there. The necessity for this is obvious. (1) It is important to know exactly what was planted in the bed. (2) An accurate record of the natural yield of the beds is desired.

VI. *Methods of Planting.*—Several methods of planting were tried. The best way for the experimental beds was the individual planting of each clam. The method consisted of making a hole either with a pointed stick or finger, and dropping in this the clam, siphon end up. Clams can be thus kept at the right distance from each other. Lines were marked out either by string stretched across the bed, after the manner of garden planting, or by grooves made with a marker.

The practical method for large beds is merely sowing the clams and spreading them evenly over the surface. It has been found that a small clam can burrow into the sand faster than a large one. An inch clam is a very rapid burrower, and therefore is an excellent size to sow. The only trouble with this method of planting when applied to small experimental beds is that the tide bunches the clams together, causing them to go into the sand in clusters. This can be helped somewhat by turning

over the surface of the ground. Dr. Mead of the Rhode Island Fish Commission found that a greater per cent. would burrow when the ground was dug over than when left undisturbed. A method used some years ago in Essex consisted in breaking the surface with long-toothed rakes before sowing.

A third method of planting, used for exact work, was obtained by constructing a light framework of laths, containing exactly $\frac{1}{1000}$ of an acre, and divided into square feet by heavy cord. At the time of planting, this frame was placed upon the bed, the corners fitting upon the sunken posts. Clams were planted with different arrangements per square foot, both in numbers and size, and a record kept of this. When the clams are removed, the same frame is replaced, and the exact position of each square foot of clams can be obtained.

VII. *Wire Baskets*.—In determining the maximum production per acre an important question was, how many clams to the square foot could exist, and what arrangement of those would afford the best growth and simplest method of digging.

Wire netting (one-inch mesh) was buried perpendicularly in the sand in the form of squares, each containing one square foot of surface. This seemed an advantage over tiles, as the open mesh was a nearer approach to natural conditions. A number of these squares were placed in the beds, and different numbers and arrangement of clams of the same size planted. In many cases the clams were notched with a file,—a sure way of indicating an increase in growth.

The conditions which govern the growth of the clam, although in appearance simple, are nevertheless very complex. The conditions in one locality may be entirely different from those in another, so it is hard to set down any rigid set of rules concerning the growth of the clam. During the past year experiments have been made to illustrate the following conditions and their effect upon the growth of clams: (1) Comparison of growth in rapid and slow currents; (2) the food of the clam, and its influence upon growth; (3) growth in crowded and thinly planted beds; (4) growth under low water and under various lengths of tide; (5) relation of density of water to food and growth of clam; (6) effect of chemical nature and condition of soil; (7) comparison of growth of different sizes of clams under same conditions; (8) enemies, such as starfish, *Lunatia* (commonly known as "winkle"), etc.

A part of the work undertaken this summer was the planting of artificial beds on barren flats. Flats were chosen where the conditions appeared favorable to the growth of clams, but which were then barren, and had been thus for many years. Most of these experiments were conducted at Essex, and many of these flats had once been productive. An especially interesting and important side of the work is to prove that hundreds of acres of our clam flats now unproductive can be reclaimed and made profitable. The methods followed were similar to those used in the other experiments.

Hardly anything is known about the conditions determining the set of young clams. The egg of *Mya* unites with the male cell in the water. After fertilization a ciliated embryo is produced, which swims in the water for a week or more. During this time it is under the con-

trol of the tides and currents, with the result that it often is carried great distances. When the right conditions are present it sets both below low water and between the tide lines, although in most cases the clam does not strike good ground, and soon dies. Often the set is extremely irregular; one place will have a very heavy set, while another will have none; one locality may have a heavy set one year and not any the next, thus proving that the success of a set is determined by a combination of favorable conditions.

The sets of young are often very heavy. Observations are now being taken of a very heavy set in Annisquam River, where in many parts the clams are as thick as 600 to 1 square foot of surface. These clams average one inch in length, and are forcing each other out of the ground by their growth.

A set may appear any time in the summer, and even in the fall, the set in Annisquam being as late as August 20.

A biological survey of the Massachusetts clam flats is now under way, with the following objects in view: (1) probable area of clam-producing flats; (2) the area of barren flats capable of producing clams under proper cultivation; (3) those flats which can be cultivated at slight expense, and those at greater expense; (4) biological conditions of these flats.

Experiments for next year will be conducted along the following lines, in addition to those already begun: (1) Experiments with different designs of spat collectors will be made in order to determine the most satisfactory means of successful spat collecting for commercial purposes. (2) Accurate and systematic observations of the spawning season will be conducted, with the following points in view: (a) length of season; (b) conditions influencing this; (c) size and age of a clam when it spawns; (d) which furnishes the best spawn, old or young clams. (3) Study of early life history. (4) Enemies. (5) Further growth experiments on a commercial basis, and study of conditions influencing the growth of shellfish.

SCALLOPS.

The common shallow-water scallop (*Pecten irradians*) inhabits the waters south of Boston. In the past this shellfish has been exceedingly abundant in the coast waters of Cape Cod and Buzzards Bay. For many years its value as a commercial commodity was unknown. The last two seasons have shown a rapid decline in the scallop fisheries, resulting this year in a great scarcity of scallops along the Massachusetts coast.

An important part of the summer's work was obtaining reliable information concerning the life and habits of the scallop, upon which a definition of the term "seed" scallop could be based.

The general law in regard to the capture of seed scallops (section 84, chapter 91, Revised Laws) reads as follows: —

Whoever takes seed scallops from the flats or waters of the Commonwealth shall be punished by a fine of not less than twenty nor more than fifty dollars for each offence; but such penalty shall not be incurred by any person taking such scallops who returns them alive to the flats or waters from which they were taken.

As this law now stands, it is useless, as no conviction can be obtained when the term "seed" scallop is not defined. For this reason there is a distinct need of a corollary to the law, which will define the term "seed" scallop.

The life of a scallop under natural conditions covers usually from twenty to twenty-two months, only a very few scallops ever passing the two-year mark. Knowledge of this fact is important, when the spawning season is considered. A scallop spawns when a year old, the spawning season in Massachusetts lasting through June and July. As the majority of scallops do not live more than twenty-two months, it is at once apparent that the scallop spawns but *once* in its lifetime. Applying this to the term "seed" scallop, we come to the conclusion that a seed scallop must necessarily be less than one year old; that is, a scallop which has never spawned. Therefore a seed scallop will be defined by designating it as a scallop of the last summer's set.

Considering the fact that in general a scallop spawns only once, it is immediately apparent that any wholesale capture of seed is peculiarly a menace to the future of the scallop industry. The scallop entering upon its second winter can be taken without injury to our scallop fishing, as it has spawned the previous summer, and the majority are destined to die during the approaching winter, either at the hand of nature or of man. Although each seed scallop is capable of producing at least 100,000 eggs, relatively very few of these eggs reach maturity, and only by overcoming adverse natural conditions. In this way any destruction by man soon makes itself felt. This year shows a scarcity in the scallop market, and it cannot be denied that man as well as the last severe winters has been a potent factor in this scarcity. A surprising feature is that the fishermen who take seed scallops do not seem to realize that they are injuring their own interests, but put forth the excuse that the winter would kill the scallops if they did not take them. By waiting another year the fishermen could reap these advantages: (1) larger scallops, (2) better prices, (3) less labor, (4) and above all, insure the future of a profitable industry.

To a person unacquainted with the rapid growth of young scallops it may seem incredible that scallops spawned early this summer are large enough for market. The chief amount of growth occurs in the summer, and a scallop will be little larger next spring than late this fall. Although there are scallops of all sizes, owing to conditions of growth and differences in time of spawning, the majority of young scallops are of a size profitable to capture. With an increasing demand in the market, a greater quantity of seed is taken, as only when prices are high does the capture of seed scallops become profitable. In this way a relation is established between scarcity in the scallop supply and the capture of seed. Wherever large scallops are abundant, it does not pay to bother with the seed; but where there are no large scallops, the seed will be captured, as is shown at Chatham, where seed scallops were the only kind taken this season.

Statistical Work.

Per Cent. of Seed Scallops taken.—The method of work consisted in visiting shell heaps at various scalloping centres, and determining by count the per cent. of seed taken. This work was carried out early in the summer and in the fall at the height of the scalloping season, when the catch could be observed.

As a rule, the percentage is not high. The lowest per cent. taken was found at Nantucket, 1.1. In 1904 on Cape Cod the per cent. was as high as 8.3. As has been said before, the entire scallop catch the season of 1905 at Chatham and Dennis consists of seed scallops. Ninety-eight per cent. of this catch are seed, as practically no other scallops can be obtained. Up to Jan. 7, 1906, the total shipment from South and West Chatham amounted to 1,165 gallons. Twenty men are engaged in the capture of seed scallops, but some of these do not make it a steady business. A man can obtain from 2 to 5 bushels every day he scallops. At Dennis the capture of seed scallops is more recent, as the scalloping only "struck in" after January 1. Six men make it a business, and an average catch for each is from 3 to 4 bushels. Such wholesale destruction of seed scallops does far more damage than ice or any other natural causes in producing the alarmingly progressive depletion of our scallop industry.

From these figures it can be seen that a large amount of seed is being taken, and I again advise that action be taken legally to put an end to such practices.

It is possible for the fishermen to separate nearly all the seed from the other scallops in culling, as they can recognize at a glance the seed scallops. There is a newness about the shell, a color which sharply differentiates it from the old scallop. The seed scallop is usually smaller and thinner, the shell is free from *serpula*, *crepidula*, etc., and it does not have the worn appearance of the old scallop. It has no well-marked growth line, but this is not an infallible test. It is impracticable to use the growth line in defining the term "seed" scallop. There is a halt in the growth of a scallop just before the spawning season, and when the new growth begins a line called the growth line is formed. In some scallops this is very prominent; in others faint. The trouble in using this to differentiate a seed scallop is that there are other causes which stop the growth and form similar lines. As in many cases these lines are on the small scallops, it is therefore impossible to make any classification on this basis.

Growth Experiments.

Monomoy Experiment.—July 10, 1905, a wire pen was constructed in the Powder Hole at Monomoy Point. The water in the pen at low tide was 1½ feet deep. The pen was situated to receive full benefit of the tide, and thereby a good food supply. In the larger divisions of the pen 150 scallops were liberated. These were obtained from Dennis on Cape Cod after much difficulty in finding any for this purpose. Two weeks were spent in dredging along the south shore of

Cape Cod, the result proving conclusively that there were scarcely any scallops along that coast. In the second division of the pen were placed scallops of considerably smaller size, which were obtained at Nantucket.

Three methods of measuring were used: (1) measuring with calipers the height, width, and thickness; (2) volume by water displacement, which gave the true increase in growth; (3) average number per quart.

Unfortunately, measurements could not be made often during the summer, and only three sets of measurements were taken. However, these show the comparatively rapid growth of these shellfish.

Division 1, Cape Scallops: In a period of eighty-seven days (July 10 to October 5) a gain of 20.58 per cent. was recorded; in sixty-three days (October 5 to December 7) a gain of 11.33+ per cent. was obtained.

Division 2, Nantucket scallops: In a period of forty-six days (August 20 to October 5) a gain of 23.316 per cent. was made; in sixty-three days (October 5 to December 7) a gain of 19.87 per cent.

These results show two important facts: (1) the smaller scallops (Nantucket) grew faster than the larger scallops; (2) the growth during the months of August and September was faster than that of October and November, showing the influence of cold weather.

Measurements were made at intervals during the summer, showing the growth of the scallops at Nantucket. The measurements were made with calipers.

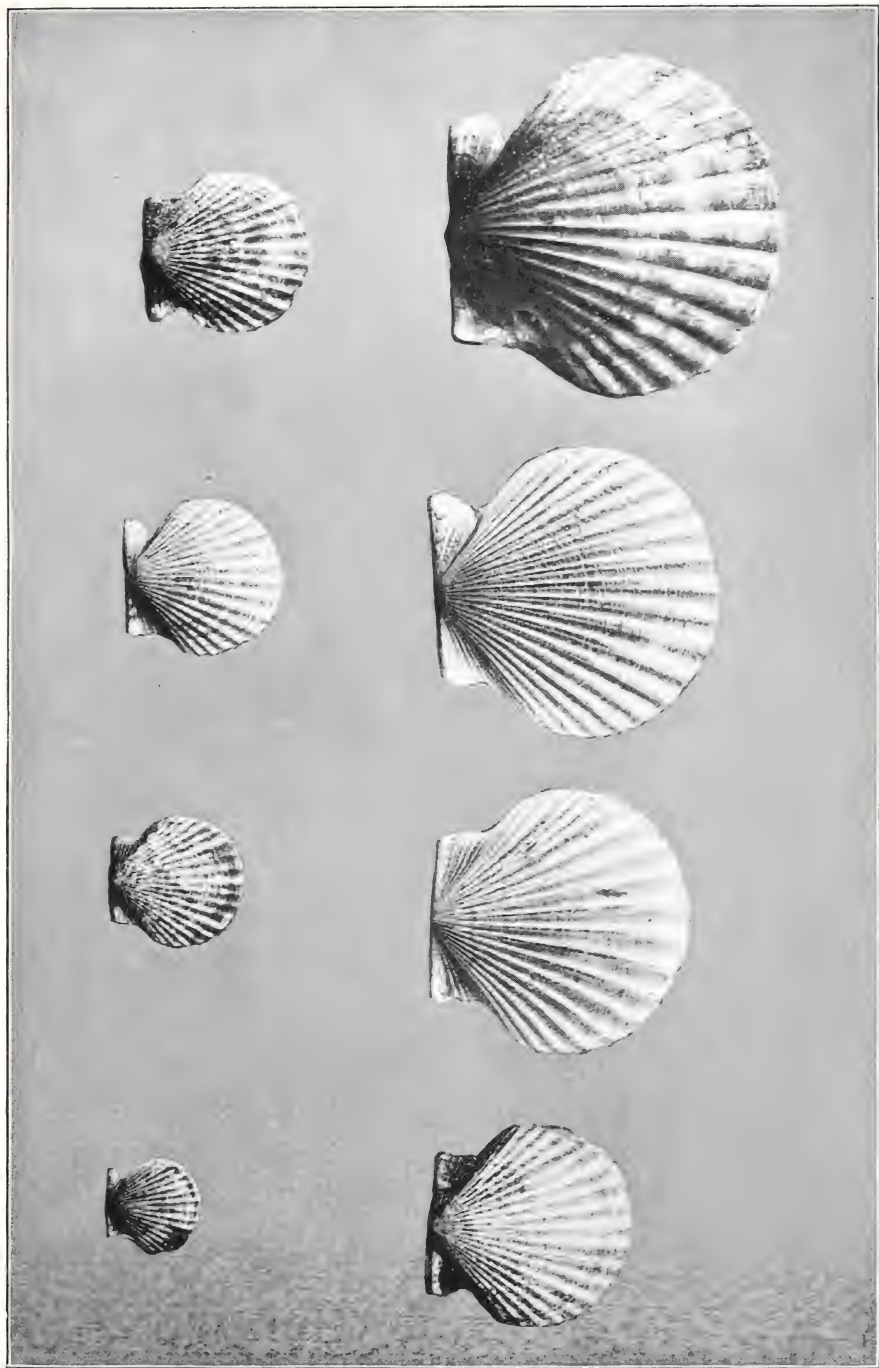
Observations were made for a short time on the growth of the scallops of the set of 1905. Their growth is very rapid, and they often exceeded in size the small-sized old scallops.

Very little is known concerning the early life of the scallop. It is first noticed when extremely small, attached to eel grass by a byssus thread, which it can cast off at will and immediately spin another. This is known as the attachment period, and lasts for an indefinite time, large scallops being sometimes attached. This usually ceases when the scallops are the size of a silver dollar, and they remain free. This period seems to afford them a rapid growth without any check until detached.

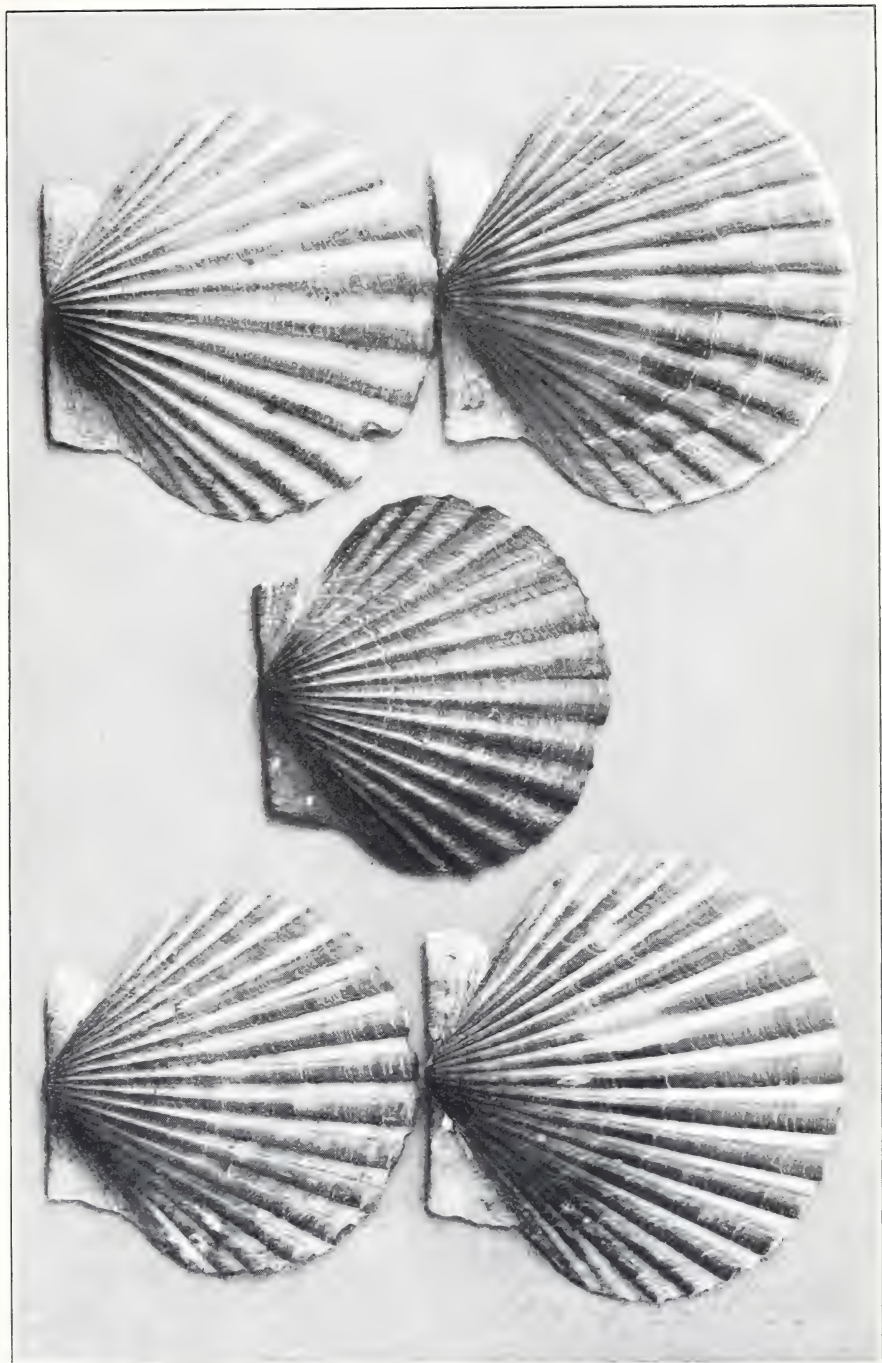
Measurements in volume of penned scallops show an increase of 31.67 per cent. in twenty-one days, the scallops when first examined measuring one and one-half inches in width.

There are great variations in the size of the young scallop. This is due either to difference in food supply, or time of spawning, or both. This calls our attention to the spawning season. The methods used in following the spawning of the scallops were by (1) examination of eggs with microscope; (2) recording the color of the egg sac, which is a bright orange when the scallop is ready to spawn. Owing to a late start, a complete examination of the first part of the season could not be made.

Two facts were observed concerning the spawning season. One was the variation in conditions that influence the spawning. Within two days two sets of scallops under different conditions were ob-



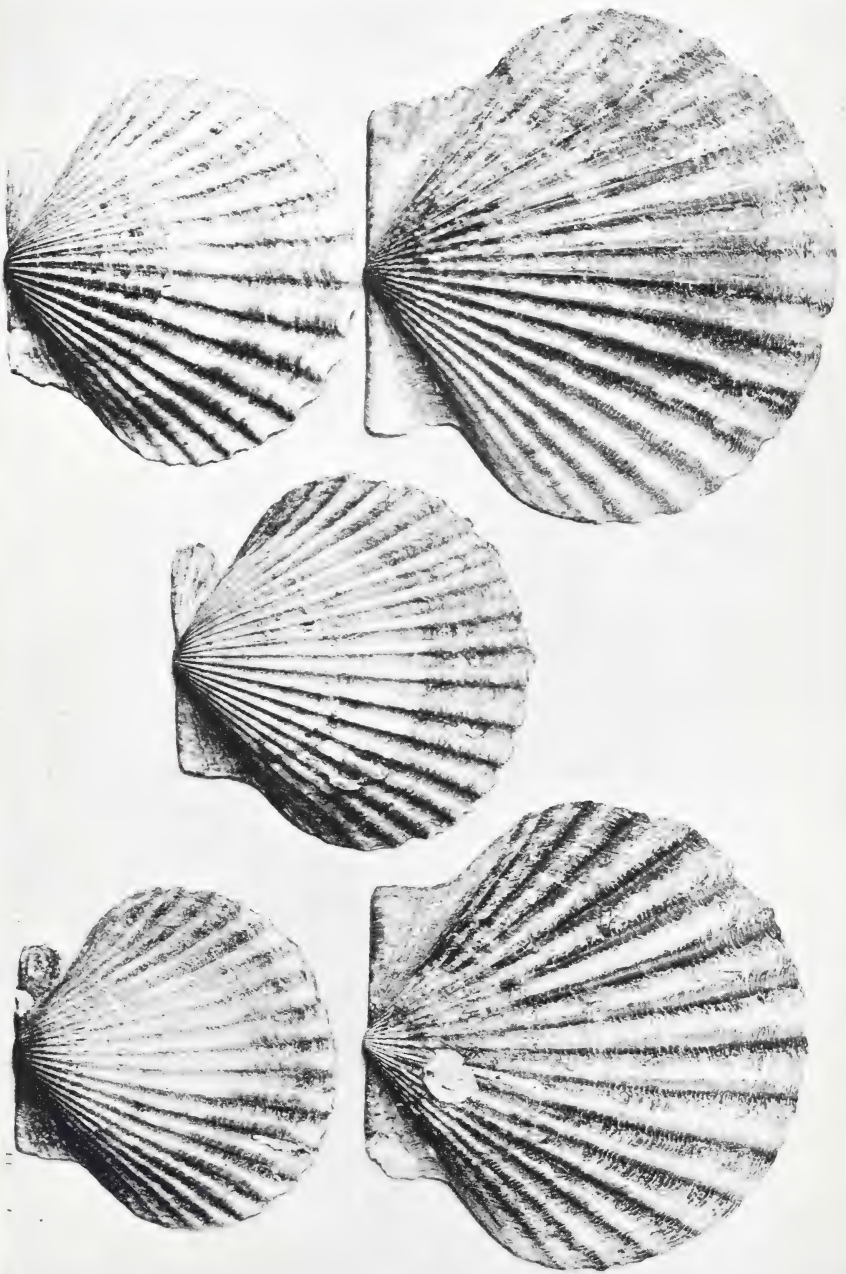
Scallops taken in one dredging at Nantucket, Nov. 7, 1905,
showing variation in size.



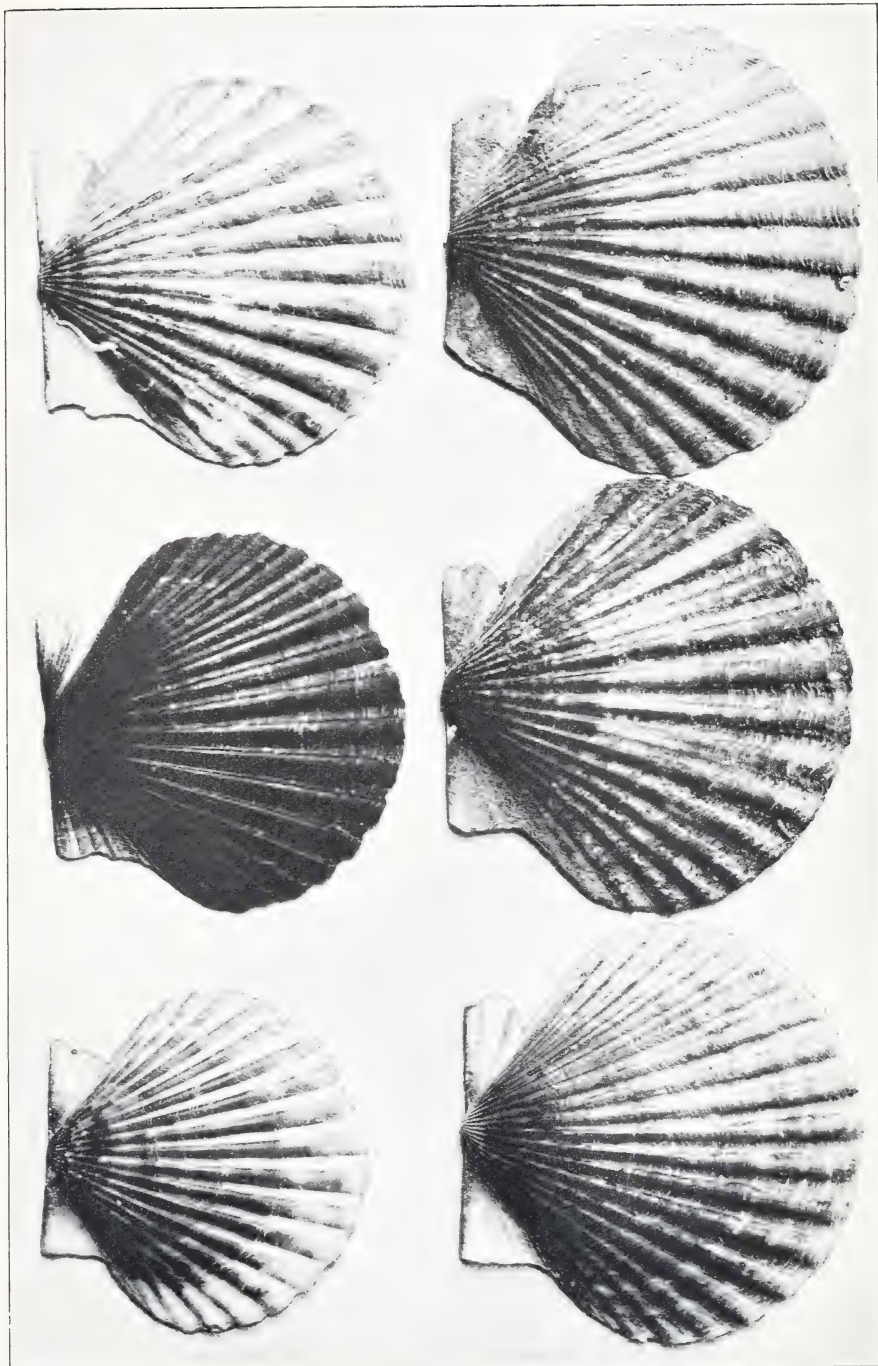
Scallops showing two or three lines which indicate temporarily arrested growth



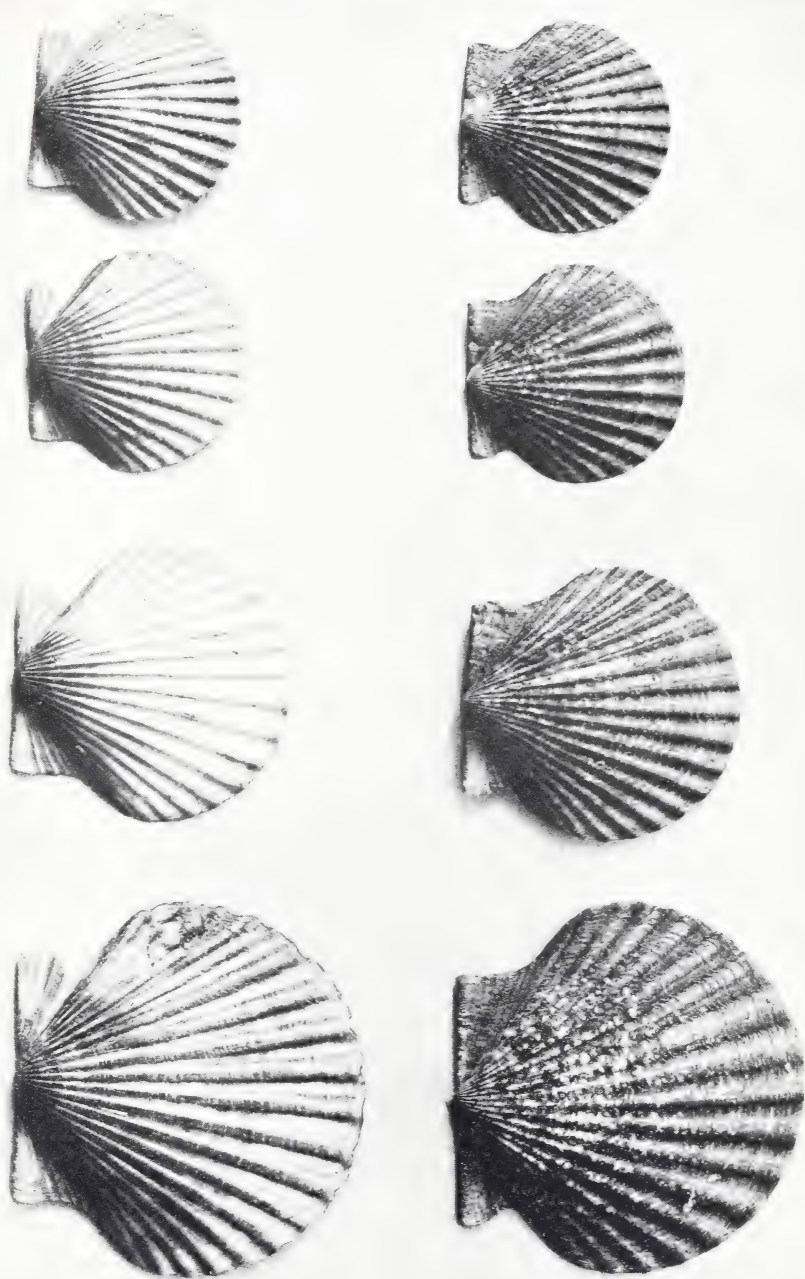
Scallops showing variation in size of growth line, indicating the impossibility of thus defining "seed" scallops.



The three smaller specimens (left) are adult scallops, from Edgartown.
The two larger (right) are "seed" scallops, *i.e.*, less than
one year old, from Hyannis.



Average size, on Dec. 1, 1905, of "seed" scallops taken at Chatham for market, *i.e.*, scallops hatched from eggs laid during the preceding summer.



Living scallops, taken from crop of elder duck
by J. H. Hardy, Jr., Chatham, 1906.

served. One set had nearly all spawned, while very few of the other had started. The chief difference was probably that of temperature, which is also shown when it was observed that the shallow-water scallop at Nantucket spawned earlier in the season than those in deeper water. The rule, the warmer the water the earlier the spawning season, seemed to hold true. The second fact noticed was the difference in the time of spawning of the Massachusetts scallops compared with the Rhode Island scallops, which spawned earlier. This is again probably due to temperature. The spawning season in Rhode Island lasts through June, while in Massachusetts it was observed to last through part of June, July and even till August 20, when it was found that 30 per cent. had not finished spawning.

Another part of the work was the investigation of the extent of the 1905 scallop fisheries. This season was marked by a great scarcity in scallops. The only places where any large amount of scallops is caught are Nantucket and Edgartown. A few scallops are caught at New Bedford, Cotuit, Hyannis and Chatham. This scarcity has been the cause of the recent high prices, scallops wholesaling as high as \$3 to \$5 a gallon. The severity of the winter of 1904-05 has, in my opinion, been the chief cause of the scarcity along Cape Cod.

An estimate of the yield of the scallop fisheries of Massachusetts gives 30,000 gallons as the yield for the three months of October, November and December. Two hundred and fifty men made a business of scalloping this year, although the exceptional run of codfish in Vineyard Sound has drawn away many scallopers. At a minimum estimate, 250 men at eighty days, $1\frac{1}{2}$ gallons per day (probably a low estimate), equals 30,000 gallons during the season.

An excellent opportunity for work on the scallops next summer will be afforded by the presence of a large number of these shellfish in the Powder Hole at Monomoy Point. Investigations on the following points will be conducted: (1) The early life history will be studied, with the view of determining the conditions influencing the set, and any practical methods of increasing it. In carrying this out, artificial fertilization will be attempted. (2) Study of the attachment period, and its influence on the life of the scallop. (3) Further investigation of the spawning season. (4) Migration of scallops, and causes. (5) Enemies. (6) Transplanting to waters north of Boston. (7) Further growth experiments in relation to scallop culture.

QUAHAUGS.

Although widely known as an article of food, the quahaug is the least known of any shellfish from a scientific standpoint. Nothing is known on such important points as: (1) early life history; (2) spawning season, length of spawning season, age and size of quahaug when it first spawns; (3) rate of growth and conditions influencing this. The importance of such knowledge of the life and habits of this shellfish can hardly be estimated. Only from this knowledge can satisfactory laws and regulations controlling the quahaug industry be made, and methods of perpetuating our quahaug supply be devised.

The quahaug, or hard-shelled clam (*Venus mercenaria*), is found usually below the low-water line, though occasionally it wanders between the tide lines. The different conditions under which the quahaug lives required modifications of the methods used in clam experiments, and in many cases they were entirely different. The experiments were conducted on a smaller scale than the clam experiments, and necessarily were of a more preliminary nature, as this was an entirely new field.

In obtaining the rate of growth, the work was handicapped by our inability to find quahaugs of sufficiently small size to get the whole rate of growth. Fortunately, a place was discovered, August 20, at Nantucket, where quahaugs of extremely small size could be obtained. Work was at once begun, and beds located at Nantucket, Monument Beach, and Monomoy Point. In the first two the beds were located in oyster grants, for protection. The main part of the experiments has been carried on at Monomoy Point.

It was found that beds could most easily be made by sinking clapboards in the mud or sand, level with the surface. The quahaug in its wandering cannot get over this, and is thus penned in. It was found impossible to satisfactorily sink larger boards, owing to their buoyancy in the water.

Quahaugs of all sizes, from one-fifth of an inch to two inches, were planted. These were all carefully measured and placed in compartments according to size. The methods used in determining the rate of growth were measuring with calipers and determination of volume by displacement in water. The true increase in growth can be determined in this way without the slightest error, as the shell shuts closely. The growth of a quahaug from one inch to two inches is not merely a gain of 100 per cent. but of 550 per cent., when the volume is considered. A table showing the displacement of the quahaugs of various sizes has been made. Another method to show the increase in growth was by notching the edge of the quahaug shell with a file, enabling one to distinguish the old from the new growth.

The rate of growth is being observed under various conditions, such as: (1) on a bottom where eel grass is plentiful; (2) on a free bottom, both mud and sand; (3) in rapid and slow currents; (4) between the tide lines; (5) in a wire rack, in rapid current; (6) at various depths of water (box experiments). A comparison of the results obtained from these experiments should show the best natural conditions for rapid growth. The maximum production per acre is being determined by a method similar to that used with the clam.

The following experiments will be undertaken next summer: (1) Artificial fertilization, and a detailed study of the early life history of the quahaug before it sets. (2) A method of spat collecting which will be of practical benefit to the quahaug industry. (3) Observations on the spawning season, considering the following points: (a) length of season; (b) age of quahaug when it first spawns; (c) which furnishes the best spawn, an old or a young quahaug. (4) Continuation of growth experiments. (5) Continuation of commercial experiments in regard to the maximum production per acre under various conditions. (6) Food and its relation to growth of quahaug. (7) A knowledge of its life, habits, enemies, etc., which should prove of value to the quahaug industry of Massachusetts.

OYSTERS.

In the first part of the report I gave reasons why I paid special attention to the other shellfish in starting my work. A biological survey of the oyster beds of our coast has been begun this summer. Experiments in oyster culture will soon be put under way, and conducted along the same lines as the other shellfish experiments. Naturally these will be of a more specialized and advanced nature, as the life and habits of the oyster have been more carefully studied than those of the other shellfish.

CONCLUSION.

During my summer's work, two things, which I should like to bring before the commissioners, have come to my attention.

The first is in regard to the length of the scallop season. The present season allows scallops to be taken from October 1 until April 1. I should like to present the question of changing the opening of the season from October 1 to November 1. My reasons for this are twofold. First, the scallop grows considerably during the month of October, and it would be an advantage to have a larger and better scallop. My second reason is perhaps stronger, as it concerns the fishermen directly. The fact that men who scallop are forced to give up their other fishing and begin scalloping at once, so that they may get their share of perhaps a more lucrative industry, is a disadvantage to our fisheries, as these men could have made a living the month of October at other fishing. I have spoken with many fishermen, and they favor a later season, for that reason. Without doubt this change would be in favor with a large number of fishermen, owing to the present scarcity of scallops and the exceptional codfishing in Vineyard Sound. There are two obstacles. One is, the men who do no other fishing than scalloping; the other is one that does not appear probable, namely, a large amount of scallops, which would not give time to capture all if the winter were severe.

Secondly, I should like to call attention to the disadvantages caused by town control of our shellfisheries. One town may make a law to oppose another town, and will often injure its own interests thereby. In this connection the condition at Dennis, during the winter of 1904-05, was an instance. As scallops were remarkably abundant, the town made by-laws intended to exclude from its scallop fisheries the residents of other towns. At the close of the scalloping season the scallops were still abundant. This year they believed they would get the rest. Not a single scallop of that set was to be found; they had died. If other scallopers had been allowed to go there, thousands of dollars could have been saved, and many scallopers given employment. This is only one case out of many which show the disadvantage of town laws.

I merely mention these two facts, which have impressed me this summer, and hope that a thorough investigation of each can be made.

Respectfully submitted,

DAVID L. BELDING,
Biologist.

INLAND FISHERIES.

The past year has been a rather unsatisfactory one, particularly in the western half of the State. A prominent cause was the abnormally deficient autumnal rains. This led to unusually low water in the brooks. The extremely cold winter in many instances froze brooks solid, and thus killed many small fish.

In the western part of the State, as a result of the close fishing of the brooks by those who aim for "record catches," the fish have been kept "caught up" to the 5-inch limit. There is, therefore, as was to be expected, a smaller number of 7 to 9 inch trout. With a few seasons of a 6-inch law, properly respected, more fish 6 inches and over will be found. Continual improvement is to be expected in the fisheries of our public streams and lakes, through the increasing development of a finer public sentiment regarding the fish and game as public property, which should be protected against unlawful depredation and wisely maintained for the benefit of the entire public.

Although 1,861,443 fry and fingerlings of all species have been distributed to public waters during the past year, that number is far insufficient for properly stocking the streams. The entire product of the Adams, Hadley and Sutton hatcheries should be distributed in the western portion of the State. To meet the demands from all sections, the lots of fry and fingerlings are necessarily so small that satisfactory results can rarely be attained. The introduction of such small quantities of fish as those to which we are now constrained is too often futile and unnecessarily expensive. The expense of rearing and transporting a sufficient quantity of fry or fingerlings to produce results would require relatively little additional expense. Our hatching and particularly rearing facilities are notoriously insufficient to meet properly the demand made upon them. A hatchery with rearing facilities sufficient for an annual output of at least 250,000 fingerlings should be established.

The practice of artificially maintaining the supply of fish in public waters is operative in well nigh all of the United States and Canadian Provinces, as well as in Great Britain and the continent. It has proved to be a thoroughly practical

proceeding, both on economic and recreative grounds. Reports are frequently received of improved conditions in Massachusetts as the result of stocking; yet, from the number of anglers who during the fishing season seek the brooks and lakes for recreation and for food, it is remarkable that the annual catch does not more appreciably decline.

Change of Regulation of Fishing in Stocked Ponds. — This department has instituted certain changes in the regulations placed upon fishing in stocked ponds, which it is hoped may prove satisfactory. Fishing in State ponds hereafter stocked will be open on every week day from June 1 to November 1, instead of Mondays, Wednesdays and Saturdays. Sunday remains a day when fishing is prohibited by the Sunday laws of the Commonwealth. Since it was decided by the late Attorney-General Knowlton that it was not within the province of this department to enforce the Sunday fishing law, the responsibility for the satisfactory enforcement of this law falls upon the local police and constables, unless the pond has been stocked and closed by this department. In this case arrests will be made by our deputies for fishing in closed waters.

Pollution. — The law against pollution of State waters by sawdust has been enforced vigorously, wherever in the opinion of the commissioners the fisheries were sufficiently valuable to warrant. In these cases we have used our best endeavors to protect the fishery rights of the people of the State, without placing undue hardship upon sawmill owners. Whenever we found that any considerable inconvenience or financial burden was likely to be caused, we have conferred with the sawmill owners. If a disposition to comply with the law was evident, we have given a definite period during which the necessary changes might be made. Prosecutions have been made only in case of wilful and persistent violation. During the year legal orders against allowing sawdust to enter streams have been served upon 17 mill owners. Fourteen different cases where owners had continued to violate the orders served in 1903 and 1904 have been called to court. All have been convicted. One was convicted twice, making a total of 15 convictions.

The people should see to it that the pollution of streams by sewage, acids and gas works and factory wastes should not be allowed to increase. The problem of the proper disposal of

waste products should be considered previous to the location of manufacturing plants. The streams of our State should be protected by law, both upon sanitary and economic grounds, from pollution by sewage, factory, mill or distillery wastes, etc., refuse from gas works, crude petroleum or oily hydrocarbons, etc. Such laws are in force in some of our States and in Europe. Much of the material which now enters the water could be utilized to advantage at slightly greater expense if dumped upon waste or cultivated land, after the English and German practices. Such a law would be a benefit to the fisheries, to agriculture and to the people, both for sanitary and for æsthetic reasons.

Game Fish. — From the State hatcheries 1,799,000 fry and 62,375 fingerlings have been distributed to the ponds and streams of the State. Twenty millions of landlocked smelt eggs have been placed in ponds which have been or were about to be stocked with brown and rainbow trout and landlocked salmon.

The Bureau of Fisheries has furnished to this department 100,000 brook trout eggs, 20,000 landlocked salmon eggs and 5,000,000 pike perch eggs.

Through the Bureau of Fisheries we have introduced the large-mouth black bass into Billington Sea, King's Pond and West Pond in Plymouth.

Carp. — We do not recommend the distribution of carp, and only furnish them for special purposes, such as clearing out excessive vegetation in isolated ponds, and then only when the pond is so situated that the fish are not likely to extend into other waters. There seems to be no question but that the carp may multiply to such an extent as to limit the supply of more desirable fish. Probably it destroys many eggs of the better class of fishes. Though the carp has special uses, in general we are inclined to limit our endorsement, and advise against the introduction of this fish directly or indirectly into public waters. "For those who want that kind of a fish, the carp is just the kind of fish they want;" but it is not wanted in the best waters of this State.

Shad. — The State did not get its quota of shad eggs from the Bureau of Fisheries, owing to the comparative failure of the hatch in the Susquehanna River.

The shad question is worthy of special consideration. It is a fact that, if shad had not been artificially propagated by the United States Bureau of Fisheries, the shad fisheries on our entire Atlantic coasts would have long since been commercially extinct. Notwithstanding the success of the shad work, the facilities furnished by the national government are not sufficient to furnish to the several States a quota sufficient to satisfactorily stock and maintain the supply in their respective shad streams. Under these conditions it seems eminently proper that every State having possibilities for shad fisheries should take the necessary steps to hatch and distribute shad fry to stock its own public rivers, to the economic advantage of the public. Such a procedure would not be expensive, and, in our opinion, could be made commercially profitable, whether carried on by the State or by a business corporation controlling the fisheries of any shad stream under a special license from the State. For such a license a corporation could afford to pay a very tidy sum to the State treasury.

An article in the Boston "Transcript" says:—

Hartford, Conn., April 27. Fishermen along the Connecticut River and Sound shore are looking for a first-class shad season this year and for very good times in the future; for, if the hopes of the State Fish and Game Commissioners are realized, shad will fairly swarm in the river in the next few years.

The hatchery at Windsor will be started up again on May 1 under the charge of George Fletcher, a government expert, who will have two assistants. Last year about 500,000 fry were raised at Windsor and eventually turned loose. Enough more were obtained from the government to make the number put into the Connecticut about 4,500,000, while about 3,000,000 were released in the Housatonic River. Nobody knows where they are now, but in two years more they are expected to show up,—that is, a good proportion of them,—full-sized fish.

This year the commissioners hope that from 8,000,000 to 10,000,000 fry will be hatched out at Windsor. They will be put in the Joshua-town ponds and turned loose in the fall, with every expectation that they will be back again in three years. Besides these, it is hoped to obtain from the government two carloads of fry, which means about 3,000,000 each, one lot of which will be put in the Connecticut and the other in the Housatonic.

The Boston "Post" of April 20 says:—

Portland, Me., April 19. The shad fish situation in Portland has become a serious one, as but few fish are obtainable, and what do reach

the market are expensive. Cold and rough weather is believed to be responsible for this condition. Buck shad to-day were selling at 45 cents and roes at 80 cents. The usual prices are 15 cents for the former and 30 for the latter. The shad season is about half over.

From the "Lewiston Sentinel:" —

Shad are being caught in the Juniata River at Vandyke and other localities. Two generations ago shad were plentiful in the Juniata, but the Pennsylvania canal dams excluded these fish from the stream for more than half a century. Now that the dams have been breached, the shad have returned.

STATE FISH HATCHERIES.

REPORT FROM THE SUTTON HATCHERY.

WILKINSONVILLE, MASS., Dec. 10, 1905.

To the Commissioners on Fisheries and Game, State House, Boston, Mass.

GENTLEMEN: — The trout raised and distributed from this station this year were hatched from eggs collected here in 1904, amounting to 549,000, — 509,000 brook trout, 37,000 brown trout and 3,000 salmon. In March 20,000 more landlocked salmon were received from the United States Fisheries Bureau Station at Green Lake, Me., and in April 35,000 rainbow trout eggs were received from Hadley. At the same time 25,000 trout fry were received from Hadley, and later, in July, 15,000 rainbow trout fry.

The fish hatched late because of the low temperature of the hatchery water, caused by the severe weather of winter and the scanty supply of water, which was cooled more than usual in the long flow from the springs to the hatchery.

The condition of the fish was satisfactory. The fry distributed were in excellent condition; and those reserved for rearing developed unusually well when they began feeding, and grew to be a very satisfactory lot of fingerlings. The fish at all times were free from disease, and the only unusual losses resulted from the temporary arrangements for rearing, where the means did not permit of more secure construction.

There were 309,000 trout fry put out in the spring distribution, and 169,000 were reserved for rearing, resulting in 45,000 fingerlings. The rainbow trout, brown trout and salmon raised for stocking ponds numbered nearly 25,000, the number of each kind being nearly equal. All of these hatched much later than the brook trout, consequently they made less growth, though they were all of good size and quality.

Some very pointed lessons from the varying yield from different ponds were learned; but all observations continue to indicate the necessity of improving the ponds so that the fish will be thoroughly protected. Protection by watching for the destroyers of the fish is uncertain, expensive, and at times fails completely. One planked pen that seems secure from any enemy of the fish (except kingfishers, and

these are easily killed) yielded nearly 12,000 fish,—an increase of 4,000 over the usual number; while several ponds that should have the same capacity yielded numbers varying from one-third to one-sixth of this. On one stream two connected ponds yielded 4,000 fish, though previously 17,000 had been taken from the same ponds in one year, and their capacity, judged by the yield of the planked pen mentioned, is even greater. We very greatly need a larger number of planked pens.

The loss of fish due to birds and other natural enemies was not checked, and it seems certain that in some ponds it was heavier than ever before, especially from the attacks of herons, the night heron in particular, although many ponds were covered and a close watch kept. The usual means taken to protect the fish seemed very ineffective, and it must be believed that the birds have acquired caution, as they avoided the traps which were set about the ponds in great numbers, and did not fly in until it was so dark that shooting was not practicable. The greatest damage is done during the period when the voracious young are being fed in the nest. The ponds where the most trouble is experienced are flowed or excavated basins, with shallow margins, remote from the buildings, and mostly of a size that has made covering impracticable with the means available. But it is evident that the ponds must be covered or otherwise protected if they are to be kept stocked to their full capacity. If covered, the structure should be permanent, so as not to require its erection each year after the fish are put in. In some cases, where sufficient depth of water could be secured, planking the sides would afford good protection. Many of the ponds, however, are so formed that the water could not be made deep enough. In many cases, too, the fish can be carried through the early part of summer better in shallow water, so for these ponds recourse must be had to covering. While the temporary coverings of fish netting now in use are good, permanent coverings of wire netting should be provided, so that the fish, after being placed in the pond, need not lack protection because of pressure of work at that season, when extra work cannot be undertaken.

In May an attempt to steal fish from the pond was stopped through the friendly co-operation of the Worcester police department, and the three men who made the attempt were arrested and convicted. Evidence was discovered that the thieves had been successful on previous visits. At the end of the season the brood fish were found to be about 300 short, although it is not supposed that all of these were stolen, for there is usually a considerable shrinkage from cannibalism, the larger brood fish often being seen devouring the two-year-olds put in to renew the stock. For several years the number missing has been about the same as this year, a part of the loss being laid to cannibalism and the rest supposed to be due to poachers. Adequate protection would probably cost much more than the value of the fish lost. The most serious loss comes from reducing the stock clearly below the capacity of the pond, and keeping the output much below what it should be; yet this is probably owing to a larger extent to the insufficient number of fingerlings reserved to keep up the stock. In 1903 none were re-

served; consequently the brood stock contained no two-year-olds,—the best age for breeding purposes here. In 1904 the number retained was not sufficient to make up the deficiency, and the number reserved the present year does not promise to bring the breeding stock up to what it should be.

Although the improvements most desired could not be carried out, much was done to improve the station and its equipment. As far as possible the work was of a permanent character, temporary work being done only when lack of means precluded better. A temporary arrangement of hatching troughs was placed on the brook above the pond to hatch out the late eggs, because the fry hatched so late did very poorly in the water supplied to the hatchery, which deteriorates by becoming variable in temperature late in the season when warm weather sets in. This arrangement proved very satisfactory, and will be continued as built, if a larger permanent arrangement cannot be made. A shade was built over the upper tubs, and this probably in part resulted in larger fish and increased yield there. It certainly retarded the growth of algæ in the tubs.

The roadway passing the pond, the embankment of which serves as a dam, was widened, and the plank facing and wasteway rebuilt with heavy chestnut plank. The waterway was dropped two feet, the level of the water being regulated by means of flash-boards, as at times it is very advantageous to vary the level of the pond. A strong hand-rail was placed upon the pond side. The brook was diverted into a new channel at the lower side of the lot, where some small springs flowed into the brook, and a pond was built in the former channel of the brook. The soft mud and quicksand made the task very difficult, and increased the labor, as it was necessary to excavate much deeper than was desirable, and after planking to fill in with sand and gravel to get the right depth. The side of the pond next to the new channel of the brook was heavily planked and backed with gravel to prevent wash-outs.

The lower ponds are supplied with water which oozes in through the sand bottom, formerly the bottom of a shallow pond or swamp, and to increase this supply long ditches are run from the sides of the ponds to intercept the water that passes into the brook; these ditches were extended, wells dug, and finally tile was laid and the ditches refilled. The wells are shallow, generally not over 6 feet, but they increase the flow considerably. A pipe well was driven to the depth of 17 feet, but practically no flow was secured.

A new hen house, 9 by 27 feet, was built with waste lumber from repairs to the hatchery and old pens torn out. The shingles and finish were sawed from dead timber cut on the place. The barn having settled on the back side, it became necessary to lay a better foundation; and, as an abundance of stone lay within reach, it was thought best to take out the posts and lay a stone wall to the sill of the building, especially as it would result in a roomy basement for the storage of apparatus and green food for feeding hares in winter. This room was secured by a moderate amount of excavation, and it will require no great amount of work to make the whole space available. The water supply for the house having failed several winters through the freezing of the pipe from the hydraulic ram, the pipe

was dug up, and, being badly broken, a new one was laid deeper, though possibly not below frost, because of the difficulties in digging. The grounds received less attention than usual, on account of the repair work required; but some stone and stumps were removed, and several rough places graded and seeded. Waste lumber was utilized in making a bridge below the hatchery, so that the strip of land lying across the brook, the best soil on the place, could be cultivated.

The road was gravelled in several places on the hill where it enters the grounds, because it was badly washed; and across the flat, where it was worn below the surface of the ground, adjacent land on both sides of the road was ploughed to the wheel track, making passing difficult in a season of mud. The road should be made a more suitable entrance, for the hatchery is a public place, visited by two or three thousand people each year, representing nearly all parts of the State, and including many leaders in public affairs. Through the latter part of the summer the land through which the road passes is used as a cow pasture, making it inconvenient, unpleasant, and at times dangerous for any one to reach the hatching grounds.

In May 5,000,000 green pike perch eggs were received from the United States Fisheries Bureau Station at Swanton, Vt. They came through in good shape, but immediately began to change, and in a few days were reduced to less than 1,000,000, all circumstances indicating poor fertilization. The hatching and distribution were accomplished with small loss. The glass aquaria proved to be unsatisfactory for holding fry, consequently these were put aside and only the large tank used.

In suggesting improvements for the future, it seems only necessary to renew the recommendations previously made, as they cover matters that are urgent. For the most part the improvements pointed out as desirable are not yet done; but it seems well at this time to offer a suggestion, that, if adopted, will aid in determining what work could be done advantageously.

The station should be examined with reference to improvements needed or likely to be needed, or extension likely to be undertaken, and anything done carried out in accordance with a comprehensive plan, looking to the most effective arrangement that the location will permit. The character of the work has changed, and many of the facilities for doing it are very unsuitable, while the extensive work of repairing done each year too often seems to perpetuate these unfavorable conditions. For many years the time spent in making these repairs has cut heavily into the time that should have been given to carrying out extensions and improvements, and they have often required the attention needed for routine matters; and, as fully as much will have to be done in the near future, whatever is done should be in the direction of a better-equipped and more convenient station, such as could be easily planned here. If the work of making repairs merely to restore things to their former condition continues, much of the effort must inevitably be misdirected.

Respectfully submitted,

ARTHUR MERRILL,
Superintendent.

REPORT FROM THE HADLEY HATCHERY.

BOSTON, MASS., Dec. 1, 1905.

To the Honorable Board of Fish and Game Commissioners, State House, Boston, Mass.

GENTLEMEN:—I beg leave to submit the following brief report of the work done at the Hadley hatchery during the season of 1904-05.

The stock of fish on hand at the beginning of the spawning season in 1904 was as follows: brook trout, adults 304, in the 75-foot pool, 2-year-olds 1,100, in 75-foot pool; rainbow trout, adults, 274, in section pools 1 and 2; brown trout, adults, 127, in pool between sections and the large pond; landlocked salmon, adults, 60, in section pool 3. In addition to the above-named fish, we had 142 yearling rainbow trout in section pool 4, also 40 yearling brook trout in the same section, besides 161 fingerling brown trout, 136 fingerling rainbow trout and 462 fingerling brook trout in the small pool back of the dam.

The mature fish were in excellent condition, and they yielded a fine lot of eggs during the spawning season.

I took the first eggs on October 31, when I secured 4,000 eggs from 6 brook trout. From that time on, by the advice of Commissioner Delano, I looked over the fish on alternate days; and the results proved this to be a wise plan, as some of the fish would not be ready at the time of taking one lot of eggs, and yet it would be unsafe to let them go for a whole week, as in the previous spawning season.

During the time in which I spawned the brook trout I secured a total of 246,000 eggs, the last lot of 2,000 being taken on December 21. The largest lot taken on any one day was 34,000, taken on November 7. The total number of brook trout spawned was 421. A great many of this number were of the lot of yearlings in the 75-foot pool. To this number of brook trout eggs must be added 100,000 which we received from the United States Bureau of Fisheries Station, at Leadville, Col., on February 17. This lot was exceptionally fine, and the morning after unpacking I found only 821 dead. The reason for this small loss was very simple, as the eggs were packed with the greatest care, and were protected against undue accidents during their transportation to Hadley.

From 26 brown trout I secured 32,000 eggs, from 3 salmon 4,000 eggs, and from 67 rainbow trout 84,000 eggs, making a total of 366,000 eggs taken at this station.

At the beginning of the spawning season the brook trout were, as stated above, in the 75-foot pool; and after the season was well under way we experienced considerable difficulty in getting the eggs from them, on account of the very cold weather causing the pool to freeze over about as fast as we could clear it. We finally transferred what fish remained in this pool to one of the sections, where we had no difficulty in handling them, as these places seldom freeze over.

The loss of eggs during the process of incubation and hatching was rather larger than usual, and was due in great part to the shortness of the water supply. An unfortunate accident occurred in April, and resulted in the loss of four trays (20,000) of rainbow eggs. This was

due to ptomaine poison which came down from the liver fed to the young fry in the troughs above, as the four trays were in the lower one of the string of three troughs.

In spite of all these drawbacks, caused by the failure of the water supply, heavy loss of eggs and other unavoidable circumstances, we had a good lot of fry on hand during the season; but it looked at one time as if we might lose all of them, owing to the almost complete stoppage of the water in the hatching house.

We commenced the annual spring distribution of fry on April 25. Deputy Shea of Ware was again in charge of the work of delivering the trout to applicants, and by his thorough knowledge of that department of the business aided us materially in finishing up the distribution in a short time. All the applicants seemed pleased with the fish which we sent them. I personally delivered a few lots of brown and brook trout fry which went to Turner's Falls and Athol, respectively. The fry were not generally as large as in the previous spring, but were satisfactory.

Superintendent Merrill of the Wilkinsonville station came to Hadley on April 25 to get 30,000 eyed rainbow trout eggs and 40,000 brook trout fry, which he took back to keep for rearing purposes. It was not deemed advisable to keep any fry over at this station for rearing to fingerlings, as our experience in other years proved such a course to be worse than useless.

During the past summer we kept most of the rainbow trout, brown trout and landlocked salmon in the section pools. Through some unknown cause a good many of these, our best fish, died in one night. Mr. Barlow, at that time in charge of the hatchery, reported everything all right at 7 o'clock of the evening previous to the morning on which the fish were found dead in the pools.

Our chairman, Dr. George W. Field, and Superintendent of Hatcheries John W. Delano visited the hatchery and gave Mr. Barlow directions as to what should be done. Acting on these instructions he transferred all the fish that were still alive to the large pond. Since then we have had no unusual trouble.

The town of Hadley at a special town meeting the past summer passed a resolution to install water works in the village, and appointed a committee of three of their citizens to make an investigation and report the most favorable site for the construction of a reservoir. The first site proposed was on a brook known as "Shingle Mill Brook," a short distance west of the hatchery on the mountain. After a more extended search, however, they selected the brook that runs through the hatchery property, known as "Hart's Brook." The reservoir was built about one-half mile from the hatchery eastward toward the "Little Notch." The building of this reservoir on our brook will ultimately take the greater part of the water from our large pond, and thus make it an impossibility to keep a stock of brood fish here, as in previous years. This will greatly lessen the value of the property even as a hatching station, as all the eggs used in the future will have to be brought from a distance.

On May 29, pursuant to orders received from the office, I reported there for special work, and have been located there since that time.

There were the same pleasant features about the hatchery work this summer as in the previous year. Every fine Sunday and some times during the week many visitors came for the sole purpose of seeing the fish take their regular daily meal in the afternoon. Others came who had an interest in the work because of its value in the studies which they were pursuing. Among such was a party of about fifteen students from Mt. Holyoke College, South Hadley. They were furnished, upon request, with trout specimens for use in their classes in embryology. Additional specimens were furnished later in the season. We are able to impart a little of our knowledge of the practical side of the matter by illustrating to them the methods used in securing the spawn from the fish, and the processes of incubation and hatching. These visits from students and people interested in the work in other ways bring us in touch with its different phases, and bring up many points that perhaps we have not thought of before.

On October 21 last I went to Hadley to oversee the work of changing the fish from the large pond to the small sections, to prepare for the spawning season.

The outlook for eggs this year is fair. We have on hand at the present time about 300 brook trout, 6 salmon, 47 brown trout and 100 rainbow trout. The greater percentage of the brook trout are males, and practically if not quite all of the brown trout are males.

In closing, I wish to thank the commissioners for their many kindnesses and assistance in the work, for by their help and instruction I have been able to accomplish many things that were perhaps unattainable otherwise. I also desire to express my thanks through this medium to Deputy Shea for his assistance and valuable help during the work of distributing the fry, and to Mr. George W. Barlow of Hadley, our teamster, who spared no efforts to make the distribution a success.

Trusting that this report will meet your approval, I beg to remain,

Obediently yours,

W. RAYMOND COLLINS,

Superintendent.

The Adams and Winchester hatcheries, as usual, have been utilized to the limit of their possibilities. These are hatching stations solely, and were established during the time when applicants came in person to the hatcheries for the just-hatched fry. The more satisfactory method of rearing and distributing fingerling fish had not at that time been instituted.

The total number of fish distributed by the commission in the public waters of the State during the past year is as follows, including fingerlings, fry and eggs and adults:—

Trout fry,	999,000
Trout adults,	68
Trout fingerlings,	62,375
Pike perch fry,	800,000
Smelt eggs,	20,000,000
Total fish and eggs,	21,861,443

In spite of the fact that section 65, chapter 91 of the Revised Laws, as given below, plainly states the intent of the law, the lack of penalty for its violation has led to cases where persons have made absolutely false statements for the purpose of securing trout fry and fingerlings for streams which are not open to public fishing. When such instances become known, no further fish have been furnished.

In view of this fact, we are of the opinion that no trout fry or fingerlings should be hereafter furnished except to such brooks as are throughout the entire length open to the public. To secure this, every applicant for fry or fingerlings should state in writing in the application that every owner or lessee of the land through which the brook passes has agreed that fishing on such land shall remain free to the public for the three years immediately following this stocking. Special attention is called to the law, which is explicit upon this point: —

REVISED LAWS, CHAPTER 91.

SECTION 65. No person, corporation or association shall be provided by the Commonwealth with trout or trout spawn to stock waters owned or leased by him or them or under his or their control unless he or they first agree in writing with the commissioners on fisheries and game that such waters so stocked shall be free for the public to fish in during the season in which the taking of trout is permitted by law.

There has been the usual annual mortality of fish, particularly in Lake Assowompsett, Pontoosuc Lake and others. We regret that we were unable to ascertain the causes and suggest remedies. During 1906, however, we hope to be able to give some attention to this important question.

We have, too, from pressure of other routine matters, been unable to inspect certain dams in the State where the present fishways are unsatisfactory, or where fishways should be established. We hope in our next report to announce progress. The flagrant case at Wareham Street, Middleborough, however, has been taken up, and is in a fair way to be adjusted.

GAME.

The Inland Fisheries and Game as a Valuable Asset of the State. — In addition to the reliable estimates made by our late chairman, Captain Collins, that reasonably good fishing and

hunting in the State mean that at least \$2,000,000 annually is spent within the State for such items as board, ammunition, fishing tackle, transportation, etc., the fish and game killed within this State are utilized to the economic advantage of the inhabitants, and chiefly as food.

From careful estimates based upon observations in all parts of the State, we estimate that there are to-day not less than 5,000 wild white-tailed or Virginia deer roaming about this State. We are of the opinion that by Nov. 1, 1908, when the present close season terminates, there should be at least 10,000 and possibly 15,000 mature wild deer. This should permit the killing of 1,000 to 2,000 male deer annually, representing a cash value of \$30,000 to \$60,000, as the annual profit from the Commonwealth's herd of deer. This amount will be distributed among the people of the State as meat which can be used as food by the persons killing the deer, or it may be turned into cash. The sole source of this amount of wealth is the natural reproductive increase, and is an asset just as tangible and marketable as the apple or tobacco crop. The employment of the deputies necessary to protect the deer is the only working capital required. The amount of money paid by the State to farmers for damages to growing crops represents the insurance upon the deer crop. The cost of insurance is reckoned in the cost of all business investments. The chances of failure of the deer crop are slight, and the harvesting is by those who count it "sport" and recreation rather than work.

In a similar way we have abundant covers, capable of supporting at least 50 to 100 ruffed grouse per square mile (if properly protected from illegal shooting and from the natural enemies of the nests and young, *e.g.*, the cat, fox, dog, raccoon, skunk, red squirrel, etc.), instead of the paltry 5 or 10 ruffed grouse per square mile as at present. The wild turkey is gone, and the pinnated grouse has been exterminated except one small isolated colony. The quail is maintained by the annual expenditure of \$1,000 to \$5,000 by the Massachusetts Fish and Game Protective Association and other public-spirited associations and individuals. Properly handled, the annual crop of ruffed grouse in this State should in an average season be not less than 25,000, valued at least at \$25,000, and 20,000 quail,

valued at least at \$5,000. With the prohibition of spring shooting and proper protection to the breeding birds, the crop of wild ducks in Massachusetts should be at least 6,000, valued at least at \$4,000.

Thus at a very conservative estimate the value of the State's game crop should not be less than \$50,000, and might readily exceed \$100,000. We have the territory, the wild berries, fruits, the waste cultivated fruits and grains, and especially the weed seeds and the insects in far greater numbers than at the time (still within the recollection of the men now living) when our fields and woods supported without difficulty five to ten times the present amount of game and beneficial birds.

Ruffed Grouse. — The ruffed grouse or partridge is easily our chief game bird. The past year has been favorable for the young, and there has been probably no marked decrease in numbers in this State. Yet the conditions surrounding this bird are annually becoming more severe. The cutting of the pine forests restricts the refuge areas, and the increasing numbers of gunners, with improved guns and more carefully trained dogs, making havoc which each year tends to diminish the number of breeding birds. The direct effect of human influence upon this most hardy bird has been a most alarming decrease of 50 to 75 per cent. in the past fifty years. There can be no worthier or more appropriate object for sportsmen or for lovers of nature, either as clubs or as individuals, to control areas suitable for protective covers and breeding grounds for our native game and other birds. Even a few acres of pine and cedar, where shooting is prohibited and where the woods are maintained intact, with a sunny glade and its stream of water, with barberries, old apple trees, bayberries and juniper and other fruits present through the winter, will do much towards maintaining not only this grouse, but also quail, woodcock and other wild birds.

We learn of very few instances where persons take advantage of chapter 92, Revised Laws, section 12, which permits the snaring of partridge by the owners of lands upon this land during the open season. Considerable snaring is done, however, in the State, but all the evidence indicates that it is not done by or with the knowledge and consent of the owners of

the land. It would therefore be regarded as no special hardship if the law should be extended so as to entirely prohibit the snaring of partridges in the State. This would mark another step in emphasizing the fact that both insectivorous and game birds are the property of the State, and not of the person who owns the land upon which the bird chances to be temporarily; and that it is the privilege and the duty of every land owner to extend to such public property the utmost degree of protection, for the birds are of peculiar value not alone to the public as a whole, but in a very special degree to every land owner.

Forest Fires. — Our game birds, notably the partridge, suffer severely from forest fires. Fortunately, sportsmen are acquiring a greater interest and assuming larger responsibilities in the matter of preventing forest fires. In the past too many have been started by careless smokers, and particularly by the thoughtless dropping of the modern match so much used by hunters, “warranted not to blow out in a gale of wind.” A present prolific source of trouble, too, are the bands of irresponsible aliens, who, not content with roaming our countryside in the summer and autumn for song birds, invade the woods and fields for mountain laurel, ferns and evergreens, for arbutus and other flowers which are carried to the cities, as well as for berries and other wild fruits. To such people many disastrous forest fires have been directly traced. It is the duty of every citizen to check the courses of forest fires, which are a prominent source of danger to some of the most valuable assets of the State; since the birds, trees and wild flowers contribute so largely to making our rural districts attractive for residential purposes.

Woodcock. — The facts given by Dr. E. H. Forbush in his admirable special report upon the “Decrease of Certain Birds,” in the fifty-second annual report of the Massachusetts State Board of Agriculture, are a fair statement of the present condition of this bird: —

The woodcock formerly bred abundantly in small swamps and alder runs throughout the State. Thirty years ago it bred in all suitable places about Worcester, but within ten years from that time the breeding birds were shot off. Mr. Gerry has kindly lent me a memorandum book kept by his father, Col. E. Gerry, in 1838. He tells me that the

woodcock recorded in this book were shot in Stoneham. Colonel Gerry commenced to shoot woodcock in July, therefore the birds shot must have been those breeding in the locality. On July 7 he shot 22, for which he received only \$2.75; on the 8th he shot and sold 42; on the 9th, 9; on the 16th, 20; on the 21st, 6; on the 22d, 12; on the 23d, 15; on the 27th, 8. On the 11th he shot 27 "birds," probably woodcock by the price. These woodcock were sold in Boston at 12½ to 25 cents each. After the first of August the score of woodcock shot falls off rapidly. Here are 161 resident woodcock, young and adult birds, killed by one man close to Boston in July. There were no doubt many other shooters operating about the city. No wonder that breeding woodcock disappeared rapidly from the region near Boston. The woodcock is decreasing all over its range in the east, and needs the most stringent protection. Of 38 Massachusetts reports, 36 state that woodcock are decreasing, rare or extinct, while 1 states that they are holding their own, and 1 that they are increasing slightly since the law was passed prohibiting their sale. These reports refer mainly to birds breeding in Massachusetts. In the fall of 1904, in a few sections, there was a good flight of birds from the north.

The woodcock is one of those birds which has also fallen victim in large numbers to the numerous telephone and telegraph wires, on account of its habit of flying to the feeding grounds at dusk. Unlike the ruffed grouse, which, on account of its low-scaling flight, is killed by the modern wire fences, the woodcock and rails fly at about the ordinary height of telegraph wires. On account of their crepuscular habits they are each night exposed to these dangers, where the ordinary birds are thus exposed chiefly or solely during the spring and autumn migrations.

As in the case of the ruffed grouse, better protection to the breeding places of the woodcock would be of exceeding advantage. There are many farms in this State where without serious loss a small tract known to be the shelter of woodcock could be left uncut and undrained. The writer knows that one such tract, an area of about 50 acres, which has long been known as one of the best woodcock covers in eastern Massachusetts, has been thus protected for the past four years, to the notable increase of the breeding birds.

Quail. — The "bob-white" or quail suffered very severely in the two successive hard winters of 1903 and 1904. Unfortunately for us, Massachusetts is practically the northern limit of quail distribution, and unless we can devise practical

and general means of caring for these birds during our most severe winters, we shall oftentimes be without his cheery whistle, and the insects will multiply the more rapidly in his absence. A succession of favorable seasons may bring the quail again to the southern and eastern sections of this State, but the increase is liable to be wiped out again unless serious, systematic and earnest efforts are made to protect what quail we have. This seems more feasible than to spend money for birds we know not of. Thousands of quail are annually killed to no purpose in the often ill-advised attempts to naturalize southern and southwestern quail in Massachusetts. The only chance for maintaining the quail is in a state of semi-domestication; and all possible efforts should be bent to devising some practical method of rearing our "bob-white" in confinement. Suitable locations and individuals should be sought out for such work, and should receive the hearty support, both personal and financial, of the numerous sportsmen's associations. Every one hundred dollars thus employed promises far better results than every five hundred dollars spent in the purchase and liberation of travel-worn unacclimated birds.

The reputation which "bob-white" has acquired is well deserved, for there are few birds of greater value on the farm, and none more worthy of or requiring greater protection.

Fortunately for all concerned, the market demands for quail are distinctly less than they were five years ago. The people generally are aroused to the fact that one quail in the bush is worth ten on toast; and it appears probable that public sentiment will demand very properly a strict non-sale law on quail, whether killed in this State or elsewhere. This will be for the advantage of agriculture and of rural dwellers, as well as of the true sportman. In addition, it will strengthen the hands of our sister States which have recognized the value of the quail as an asset of the State, and have passed laws forbidding the sale and shipment of these birds beyond the State limits.

The Upland Plover. — The Legislature this year placed a close season for five years upon the Bartramian sandpiper or upland plover, during which it may not legally be killed. These birds are most valuable to the farmer, for the reason that they

feed largely in the grass lands upon cutworms, grasshoppers, army worms, etc.

Forbush ¹ says:—

The Bartramian sandpiper, commonly known as the upland plover, a bird which formerly bred on grassy hills all over the State, and migrated southward along our coasts in great flocks, is in imminent danger of extirpation. Thirty-five years ago these birds bred commonly within the city limits of Worcester, about Fitchburg and in the country around and between those cities. A few still breed in Worcester and Berkshire counties, on Nantucket, and possibly elsewhere in the State, so that there is still a nucleus, which, if protected, may save the species. Their former abundance is shown by some of the statements of the old gunners. "When I was a boy, nine years old, my father killed 90 upland plover in one day. He killed 16 without picking one up." (Gerry.) This was about seventy-five years ago, in the days of muzzle-loading guns. "Breeding birds, or those living on Nantucket, have fallen off 66 per cent. in the last fifteen years." (Mackay.) "Upland plover extinct here from hunting, but breeds sparingly in northern Worcester County." (W. S. Perry, Worcester.) Five reports from localities where this bird formerly bred give it as nearing extinction, and four as extinct.

This bird, although very shy, has been persistently hunted for the table. Further, as a ground-nesting bird the encroachments of civilization, with the accompanying cats and dogs, have seriously interfered with the rearing of young.

The Pinnated Grouse (Tympanuchus cupido).—It is not generally known that a small remnant still remains in Massachusetts of the large number of pinnated grouse or "prairie chicken," locally called the "heath hen," which formerly ranged the scrub oaks of much of the United States east of the Alleghanies from Massachusetts to Virginia. It was especially abundant on Martha's Vineyard, where it still persists, and Long Island, where it disappeared less than thirty years ago. On the mainland it was abundant through Massachusetts, Rhode Island and Connecticut, and middle and southern New York State. In 1885 this bird was first described by our distinguished Massachusetts ornithologist, William Brewster, Esq.,

¹ E. H. Forbush, "Special Report on the Decrease of Certain Birds, and its Causes, with Suggestions for Bird Protection." Fifty-second Annual Report of the Massachusetts State Board of Agriculture, Boston, 1905.

of Cambridge, as being distinct from the common pinnated grouse (*Tympanuchus americanus*) (or prairie hen or chicken), now practically confined to the Mississippi valley. It is now generally known to ornithologists as Brewster's grouse. Since this bird is resident throughout the year, surviving our fiercest sleet and snow storms, of excellent flesh, and a game bird, it is not too much to say that were it to-day present upon the mainland it would be carefully cherished by our sportsmen and bird lovers, and would not be permitted to pass to the very verge of extinction. For this reason serious and well-devised attempts to re-establish this bird in sufficient numbers to place it beyond the possibility of extermination should be actively undertaken. First of all, measures should be immediately instituted to rigidly protect the present number (estimated at about 100) for a period of at least five years. Inasmuch as many are now killed by or for collectors, who are willing to pay \$20 to \$30 for a specimen, the fine for killing, or having in possession a bird of this species killed in Massachusetts, should be at least \$100.

It is hoped that arrangements for breeding this interesting and valuable bird under the immediate direction and control of this commission may be completed this summer, for the purpose of establishing this bird where it may again become a source of pleasure to the bird lover and to the sportsmen.

The National Association of Audubon Societies has called attention to the importance of such measures in its official organ, "Bird Lore," for 1905, page 329:—

There is one important matter that should receive the earnest attention of the Massachusetts public, and especially the members of the Audubon Society; in fact, it is of interest to all persons who care for wild life. The few remaining heath hens on Martha's Vineyard will disappear in a short time, if a law making a close season for at least ten years is not passed by the next Legislature. The fine should be not less than \$100 for killing one of these birds or taking any eggs, and they should have special protection by an efficient warden. The small number left is all that exist anywhere on the globe, and when they pass away another race of birds will be extinct. This colony is fortunately so situated that it can easily be protected, and the experiment of trying to save a species of birds on the verge of extinction will be of great scientific interest. The National Association urges upon the citizens of Massachusetts immediate action, and pledges its influence and help.

Biological Survey Bulletin No. 24, United States Department of Agriculture, 1905, says:—

If this bird can be saved from extinction and introduced into many of the eastern States it will be much more likely to succeed, on account of its woodland habits and narrow range, than the prairie hen, which requires a more open country, and usually does not take refuge in woods from its enemies. Experiments with the heath hen must be made soon, however, or it is likely to become extinct.

Shooting Season.—Upon the shooting season in general the Springfield “Republican” of December 3 well said:—

The shooting season of 1905 came to an end Thursday, and, viewed in retrospect, sportsmen are much surprised to find what a really satisfactory year it was for game birds, after all. Last winter there was an impression among the lovers of the dog and gun that the fall was to be a poor one in the woods and fields. The winter had been unusually severe, and the quail had been mowed down by the deep snow, so that those surviving were practically the few hand-fed by kind-hearted farmers. Not even the most optimistic hoped that the quail shooting this fall would be up to the average of the past few seasons. And they were not disappointed. A few years ago, when the “bob-white” was heard whistling in nearly every field, it looked as if we were to have them with us in great plenty for years to come. It was said by all that the quail would be our only game bird for years; but all-wise nature ruled otherwise, for some reason.

This season it was the ruffed grouse that furnished the best shooting, and there were more of these great New England game birds slaughtered than have fallen in recent years. They were heard drumming along the brooks in the early spring by the people who were casting their flies for trout, and during the summer many were seen in the roads, dusting themselves and taking a sun bath. When the season opened, October 1, many hunters went after them at once, in spite of the hot weather and the hardship that the sport put on the dogs. Of course the leaves were not off the trees then, and not many birds were killed; but the early gunner did good service to the grouse, for he made them gun-shy and wild, so that when the leaves fell the birds were fairly wise. And a ruffed grouse does not need a great deal of schooling in order to take care of itself. The best of the grouse shooting came last month, for the weather was delightful, the ground was fairly dry, and it was good to be alive and in the covers. It has been many years since so many ruffed grouse were killed in this section, and some big bags were brought home. In fact, the shooting was so good that it went to the heads of a number of local sportsmen, and they killed, seemingly, for the love of the killing. There certainly is nothing sportsmanlike in boasting of a string of fifteen ruffed grouse in one day, as some people have done. These men are to be pitied, and should stop talking about having restrictive game laws passed until they learn

the true meaning of the name of sportsman. A few years ago it was noticed that the ruffed grouse were plentiful to the east and west of this city, but were scarce about here. This season the conditions were changed. To the north and south there were few birds, but about here, many. This was probably due to the fact that we had a dry spring, and the chicks had a chance to grow up. Rainy weather in the early spring is bad for the tiny ruffed grouse, and there was rain to the north and south to prove this. While many birds have been eaten, there are still a goodly number left in the woods, and, if the winter is not too severe, there should be many survivors of the snows and frost to breed next spring and restock the depleted covers.

Not so many woodcock nested in this vicinity as have in past springs, and the early woodcock shooting was not good. The warm fall held the flight in check, and it was feared that it was to be a poor season, as no birds from the north came in before the middle of October. There is an old belief among sportsmen that if the flight does not begin before October 20, it will pass over us. This year was an exception to the rule. The best woodcock shooting came during the last week in October, and those who were in the woods at that time say that they found a large number of the long-billed birds. But a strange thing was noticed about the flight this year. The birds did not frequent their usual covers, and the quiet of the birch-clad hills was unbroken by the shrill whistle. It was so dry that the birds followed the valleys, and it was there that the good bags were killed. On the whole, the woodcock shooting was as good as it has been in other seasons, and the hunter has no ground to find fault.

A writer says, in the Springfield "Republican" of December 3:—

With the ruffed grouse getting more plentiful, and the woodcock holding its own, there is only the little quail to think about. It will be necessary to liberate a number of these birds next spring in order to restock the fields, and it would be a good thing if a closed season of five years' duration on them could be enforced by the Legislature. This cannot be hoped for, however, as the marketmen make too much money on the quail, and if the "no-sale" law were to cover the "bob-white," the marketmen would suffer. But the farmer should see to it that he does. The quail is one of the farmer's best friends, and these men are really the ones who are the most affected by the game laws, as it is their fields and woods that are the home of the sport. More and more farmers are posting their lands every year; and if they would band together and advance good game laws, they would save the birds from the so-called sportsmen, who talk reform, but seemingly do not carry it with them when they go afield. Our laws are wise as they now stand, except for the clause allowing the four weeks of quail shooting. This must be changed, and, as the hunter will not do it, the farmer must.



RUFFED GROUSE.

This specimen, captured September 26, was
photographed November 2, 1904.



RUFFED GROUSE REARED FROM THE EGG.

Photograph from life, October 3, 1904, by C. F. Hodge.



RUFFED GROUSE FOUR MONTHS OLD.

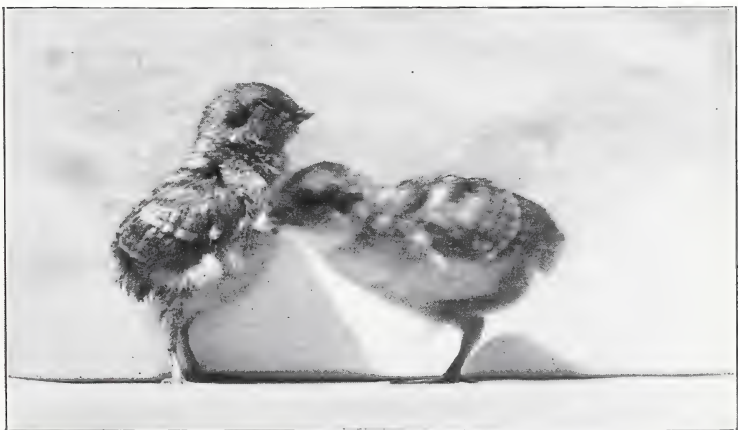
Photograph from life by C. F. Hodge, October 3, 1904.



RUFFED GROUSE ONE DAY OLD.



RUFFED GROUSE—THREE DAYS OLD.



RUFFED GROUSE—SEVEN DAYS OLD

Photographs from life by C. F. Hodge.



RUFFED GROUSE STRUTTING — Photograph from life, October 17, 1904, by C. F. Hodge.

The important experiments by Prof. C. F. Hodge of rearing ruffed grouse in confinement have been watched with great interest by many persons. His report follows:—

WORCESTER, MASS., Dec. 1, 1905.

DR. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

MY DEAR SIR:—Permit me to hand you herewith a report of my experiments with the ruffed grouse during the past season.

The grouse were very easily brought through the winter. For housing they were given the choice of a large flying cage filled with trees and brush, and sunny compartments on the south side of a small building, also filled with branches of different trees. In severe weather they were observed to spend the days mainly in the building, wallowing in the dry earth with which the floor was covered, or perched about in the branches. The nights were always passed outside, either perched in the trees or within their extensive "snow burrows."

Water was provided daily, but there was no evidence that they touched it while snow was on the ground. On the other hand, they were seen frequently eating snow.

For food they were constantly given free choice of as large a variety as possible. Budding brush of apple, black cherry, poplar, maple, willow, spruce, oak, chestnut and some others was liberally supplied, and they were observed to bud mainly on poplar and apple. They were also frequently observed to eat the dry brown leaves—oak, apple and chestnut—with which they were supplied. Rose hips and thorn apples were eagerly eaten, and the berries of black alder were taken sparingly. Their main foods, however, consisted of seeds and grains,—corn, kaffir corn, sunflower seeds, wheat, rye, buckwheat, millet, oats and barley. Oats and barley were eaten sparingly; peas and beans were refused. Sunflower seeds, kaffir corn, corn, buckwheat and wheat were preferred in the order given. The birds also ate all the acorns and chestnuts that could be procured, and also quantities of cranberries, apples and cabbage, with which they were always supplied.

In the spring their yard was spaded, freshly sodded in part and the rest thickly planted with ferns from the woods, mosses, winter-green and sweet fern. So eager were the grouse for the fresh fern leaves,—although they had cabbage, lettuce, plantain and many other growing plants,—that among the scores of large clumps planted in the enclosure not a frond was allowed to unroll. I should suppose that the tender fern buds must form a staple article of food for the grouse in the early spring.

Only one of the birds reared from the egg was a cock. He was large and vigorous, and from the time that he first began to strut in September I expected daily to hear him drum. However, the fall and winter passed, and about the middle of February the strutting began afresh, but no sign of drumming. The other cock, captured the fall before, but tame and entirely at home in the enclosure, began persecuting his rival. I therefore put him in a cage by himself some distance

from the rest. I hoped in this way to ascertain the motive of the grouse in drumming. If the lone cock drummed, it might indicate either a mate call or a male challenge. If the other cock answered, it would suggest the male challenge. However, nothing happened, and as the middle of April approached I was about ready to conclude that probably both cocks were yearlings, and that they would not drum in captivity or without instruction from the birds in the wild. Just at this juncture a letter from Mr. J. B. Battelle was received, in which he stated that his ruffed grouse (captured birds) never drummed in captivity, because, as he thought, the hens were left with the cocks. Accordingly, as a last resort, I shut up all the hens. The cock was greatly excited, and ran eagerly about searching for his mates; then, almost before I had time to take in the situation, he sprang to the top of a bit of stone wall, and, stretching himself up to full height, began to drum. As the wings moved faster he slipped off, and finished his first performance on the ground. This was April 14, and three days later the first egg of the season was laid. For about three weeks he continued to drum whenever the hens were shut up, but never when they were with him. During a drumming bout he would perform about once in three minutes, the act itself lasting from twelve to fifteen seconds. Numerous photographs were taken, but after the first two or three days the cock became so pugnacious that he would stop drumming to fight, if any one (except a certain little girl) came near the enclosure. This subject is more fully treated in the November number of the "Country Calendar," 1905.

Breeding.—By spring the flock consisted of three hens and two cocks. One of the hens had been reared from the egg; the others had been captured the fall before. Only the hen reared from the egg laid. As just stated, the first egg was found April 17. This was dropped on the floor. The hen then made her nest in the most secluded corners of the house,—an ordinary hen's nest, in fact,—and laid the remaining nine eggs of her clutch in this. The last egg was laid May 3, and May 4 she was found brooding. Five of the eggs hatched vigorous, normal chicks on the morning of May 27, making the incubation period twenty-four days. Nearly mature chicks were found in the other eggs.

I was unfortunately obliged to be away when the brood came off, and for some days before. A letter received from Mr. Battelle on the eve of my departure stated that if, as the weather got warm, the hen spends a good deal of time off the eggs, do not be alarmed. She knows better than we whether she is overheating her eggs or not. I regretted my neglect to show this letter to the one who was left in charge at first, but have since contented myself with the thought that the lesson was worth the price. The hen was thought to have deserted her nest, five of the eggs were slipped under a brooding bantam, the hen returned to her task and just five of the eggs hatched. Which five is not altogether certain, but probably the five that were not cooked under the bantam, although I have had no trouble with bantam hens in hatching the eggs. There is probably some difference in the body temperature of the two birds, though I have not tested this matter.

The cocks of the ruffed grouse are evidently polygamous. I observed the "wild" cock mate with the two "wild" hens. The hens, however,

permitted mating but once, and after mating, if left together, the cock will peck the hen to death. Mr. Battelle writes me that he had a hen killed in this way, "her skull being pecked as bare as a billiard ball." I therefore watched the pair very closely after seeing them mate, to ascertain whether Mr. Battelle's was an exceptional case. The pair got along peaceably for three days, but early in the morning of the fourth day I found the cage filled with plucked feathers, and the hen's skull pecked bare as a "billiard ball." Had I been a few minutes later, she would probably have been killed. I put about forty fine silk stitches in the mangled scalp, under antiseptic precautions, and the hen was apparently as well as ever. The above would indicate that mating occurs but once in a season, that the cocks drive the hens away after mating, and that probably the drumming is for the purpose of attracting unmated hens.

Rearing. — My permit for the year allowed me to take seven eggs. Mr. M. Leticq had under permit captured a brooding ruffed grouse and made the experiment of removing the bird and nest to his yard, to see if she might not continue sitting, and bring off her brood. Not wishing to risk all the sixteen eggs at first, Mr. Leticq brought me ten, and had them put under a bantam. The grouse hen deserted and soon died, so these eggs were made to serve my purpose. I simply wished to have some eggs hatching about the time my own would come off, so that, in case those laid in confinement were not fertile the first year, I could give the grouse hen some chicks to bring up. Since the eggs laid in captivity proved fertile, the chicks from these eggs, all of which hatched, were allowed to remain with the bantam hen.

Rearing the young birds for the first three weeks was, aside from extra precautions in preparing the foods, practically as easy as rearing so many bantam chicks. They grew rapidly, and, the weather at first being favorable, developed into apparently hardy, vigorous specimens, perfectly clean and free from vermin or disease. They were given the run of the large cage, and sought the shelter of the house at night. At the end of a week they could fly short distances, and when two weeks old began to roost by themselves, instead of brooding with the hens. In fact, they roosted in the branches with which the house was filled, alongside their respective mothers.

The grouse mother was quiet, and at first brooded her chicks much more than the hen. She never scratched, was extremely solicitous of her brood, — so actively so that it was necessary, after a first accidental encounter with the bantam hen, to protect the hen from her. She was not seen to offer her chicks an insect, maggot or other morsel of food, as hens do; but this was not necessary, since the chicks were perfectly able to feed themselves. She was also never seen to partake of any of the food provided for the young. She was in every respect a model mother. The contrast between the bustling, blustering, scratching hen, — a bottomless pit for maggots or custard, — and the gentle partridge, emphasizes the point that as quiet hens as can be obtained should be selected for rearing the grouse chicks; but after doing this, and after trying all sorts of schemes for inducing the hen to brood her chicks as much as possible, I often felt that I would like to amputate her scratching

legs close up to her head. Still, in spite of the hen's fussiness, all the chicks thrive for the first three weeks.

About June 20 we had a severe, cold rain. The chicks were carefully housed, and did not get wet. Still, they showed signs of being chilled, and went back to brooding again. They were now too large to find shelter under the hen, though the partridge could cover her five. To cut a long story short, all but one of the chicks (one belonging to the grouse hen) took sick and died during the storm or within a few days after.

Fortunately, Prof. W. E. D. Scott happened to visit me at this time, and he freely gave me the benefit of his long and successful experience in rearing and especially in feeding young wild birds. He also referred me to Dr. George Creswell, the leading English authority on bird hygiene. All the symptoms, as well as bacteriological tests made in my laboratory by Miss Anna A. Schryver and Mr. Charles W. Miller, left little doubt that acute septic fever was the cause of death in all cases. According to Dr. Creswell, the feeding of egg is a most fruitful cause of septic fever in all sorts of wild and cage birds. It seems that this food is too rich, or is not well absorbed, and the part which remains unassimilated in the intestine forms the best possible food for the germs of septic fever to grow in. If the weather is fine, and the bird has plenty of exercise in the fresh air, this may not result seriously; but let the bird encounter some unfavorable condition,—get chilled or wet, or be confined for a day or two,—and it is dead almost before we notice that anything is the matter with it. I think the principle here involved may prove of great value in rearing young pheasants and turkeys and a number of other birds. In case I am able to attempt the rearing of partridge chicks again next spring, I feel reasonably certain that, barring accidents, I can bring to maturity every chick hatched. I shall substitute “ants’ eggs,” and a great variety of insects obtained by sweeping the grass with insect nets, for custard and all forms of egg food, use as much coarse foods—greens and fruits—as possible, and carefully avoid overfeeding. While I regret most keenly the loss of our beautiful flock of young birds, I feel that the lesson learned is worth the cost many times over. I think, in fact, that it will definitely insure the success of our experiment in the artificial propagation of the ruffed grouse.

It only remains for me to add that on October 1 my entire flock of tame grouse was poisoned. The poison used was white arsenic, which was pasted over fragments of acorn kernels and thrown into the grouse enclosure. All the birds came through the summer well, and were in perfect health and feather. A quantity of the poisoned acorns was gathered in the enclosure, and chemical tests leave no doubt as to the poison used. Fragments of the fatal acorns were found in all the dead birds. The greatest obstacle which I encountered in my work was the plague of uncontrolled cats which infested the neighborhood. In attempting to keep my premises clear of these pests I must have incurred the spite of some unprincipled person, with the result above stated.

I have, however, accomplished the chief objects of our experiment. I have succeeded in rearing the ruffed grouse to maturity from the egg,

have been enabled to study in detail the foods, habits, instincts and character of the species as it has never been studied before, and I have demonstrated that the grouse will mate and rear young in conditions of domestication. I had hoped to go one step farther, and show that this could be done on a considerable scale, and rear a number of the birds which the commission could use for purposes of further propagation. I had also some correspondence with reference to sending some of the birds to England, for purposes of introduction and experiment there; and also with reference to placing pairs of the tame grouse on country estates from which they had been exterminated, where they would be carefully protected and encouraged to increase. All these plans will now have to await the rearing of another flock, which I hope to do next spring.

I wish to acknowledge the receipt from the Massachusetts Fish and Game Protective Association of a grant of \$200, given without my solicitation or knowledge, for the furtherance of this work.¹

Respectfully,

C. F. HODGE.

In addition to the propagation of fish, the Sutton hatchery has facilities for propagating game birds and mammals. A report upon this branch of the work follows: —

STATE FISH HATCHERY, WILKINSONVILLE, MASS., Dec. 30, 1905.

Commissioners on Fisheries and Game, State House, Boston, Mass.

GENTLEMEN: — For the present season the brood stock of pheasants was somewhat smaller than usual, and was reduced considerably during the breeding season by the loss of several hens by escape and death; this, with the fact that the birds laid less than usual, resulted in a great reduction of the number of eggs; the number laid amounted to 833.

The eggs were laid very early, which is a very serious disadvantage, as the benefit of the warmest summer weather for rearing chicks is lost. The eggs hatched fairly well, better than usual, but the chicks, benefited by favorable weather, did well until late into October. Some were lost because of overcrowding. The birds were held in an enclosure awaiting distribution, which was delayed, meanwhile becoming weakened. Eighteen died, or were killed by rats which attacked them while weak. When removed to a fresh pen, no further trouble was met with. In August and September 88 were shipped and liberated, and during the rearing season 15 young and old escaped and were not recaptured. Four males were liberated later in the season, when it became necessary to empty pens for use in holding other stock. At the close of the year 26 old and 22 young were on hand, — enough to fill the present breeding pens.

November 1, 2 pairs of black grouse arrived and were placed in pens which were emptied of pheasants to receive them. One pair was placed

¹ A more detailed report upon the rearing of the ruffed grouse in domestication appeared, with numerous photographs from life, in "Country Life in America," for April, 1906.

in a small pen, and, although they were protected as far as possible from outside influences, by brush placed in and around the pen, they remained untamable, and both died before the middle of December. The other pair was placed in the large central pen, surrounded by other pens containing pheasants; but of this pair the female arrived crippled, and did not recover; the male was soon tamed in a degree, remaining in the open parts of the pen, instead of hiding persistently like the others, and appears to be in a measure contented. The birds fed freely, stripping pine and hemlock brush, eating all kinds of fruit, nuts and berries, especially grapes, acorns and cranberries. They arrived at very short notice, and the best that could be done was to empty some pheasant pens and fix them over with brush; but probably the former use of the pens did not affect the result, though possibly the difference in size did. The small pen in which the pair died contained 144 square feet; the larger pen, 864 square feet.

The Belgian hares bred during the winter, and by spring a considerable stock was available for distribution; but they were held so long that many were lost from overcrowding, for not enough pens were in readiness for such a number of large ones. Many of the remaining ones were used in renewing the brood stock, which was reduced by losses and by the rejection of many unfit and diseased ones. Twelve of these were liberated about the hatchery grounds. In July, 20 hares, some nearly full grown, were liberated; but at this time for a period of nearly three months breeding was practically at a standstill, the few that did breed neglecting or killing their young. In the autumn months breeding was quite rapid, though with much loss from neglect by the parents, amounting to about one-half. At the approach of winter 50 young were ready for distribution, but it being late for that, they were held, to be liberated the following spring.

April 1, 4 male and 8 female Northern varying hares were received from Shelburn, N. H. They arrived in good condition, and were placed in movable Belgian hare coops, where they were kept until winter, when they were placed in pheasant pens. They did not breed,—probably would not, in such unsuitable pens, even if they had become more tame; but some progress was made in taming them, and it is probable that in better quarters they may breed. One escaped soon after arrival, because of some one tampering with its coop at the time of a forest fire around the hatchery, when a great crowd was present. Two in a lot that seemed untamable died before being here long; 2 died from injuries received in the pens, and 1 from intestinal trouble after being here six months.

The hares placed in secluded pens did not become nearly so tame as those placed where they could see people passing, but could not be too closely approached. No addition was made to the pens, and a few movable emergency coops were made for hares.

Much work was done on the buildings, chiefly on account of the needs of the game birds and animals; and ample room was provided for the hens, besides storage room for green feed, so that a supply can be kept for winter use; consequently, as far as material can be provided, all time available for making improvements can be devoted

to making new pens, as these are now needed more urgently than anything else. All pens made for rearing birds and animals have been for pheasants and Belgian hares, and these, being partly domesticated, will breed under conditions approximating those provided for domestic stock; but in breeding wild game little can be hoped from similar arrangements. In planning the pens for use in that work it will be necessary to make them large, so that the vegetation will not be killed or the ground become foul; more secluded, with thickets of low brush, so that the game will have shelter, but arranged so that it will become tame in a measure by the attention given it. Many admirable locations can be found on the grounds for the needed pens, particularly on the west side, above the ponds. There many pens can be located with a supply of running water, but having the greater part of the enclosure dry upland, sloping to the south.

Respectfully submitted,

ARTHUR MERRILL,
Superintendent.

From the Winchester breeding station there have been distributed during the year 378 ring-necked pheasants and 156 hares. The present stock on hand consists of 172 ring-necked pheasants and 56 hares.

Of the 12 "black game" purchased in Sweden by the commission for breeding experiments, only 1 rallied from the long confinement incident to the voyage. The 8 capercailzie which were presented to Commissioner Brackett by Swedish friends similarly succumbed soon after arrival. Commissioner Brackett writes:—

Had we a preserve where they could have been given more natural environment, the results would in all probability have been more satisfactory.

FISH AND GAME LAWS AND THEIR ENFORCEMENT.

Summary of Law-enforcement Work in 1905.

Total fines imposed,	\$4,103 59
Fines from arrests by paid deputies,	3,174 63
Fines from arrests by unpaid deputies,	928 96
Total number of counts taken to court,	353
Total number of persons arrested,	319
Convictions,	326
Cases discharged,	25
Defaulted,	2
Cases filed,	50

Classification of Arrests during 1905.

OFFENCE.	Number of Arrests.
Violation of shellfish laws,	52
Seining in great pond,	4
Illegal possession of game,	13
Setting nets,	9
Short lobsters,	22
Mutilation of lobsters,	2
Robbing traps,	2
Hunting out of season,	5
Sunday hunting,	87
Hunting without license,	25
Setting trap,	1
Setting snares,	1
Killing song birds,	20
Shooting bittern,	2
Shooting sea fowl,	2
Killing deer,	4
Setting fish trap,	1
Sawdust pollution,	15
Spearing in Connecticut River,	6
Fishing with trawls,	3
Illegal fishing,	7
Short trout,	11
Selling trout,	1
Fishing closed waters,	24
Shooting pheasant,	1
Shooting from power boat,	2

Classification of Arrests during 1905 — Concluded.

OFFENCE.	Number of Arrests.
Taking game out of State,	1
Dog chasing deer,	10
Possession of bird feathers for millinery purposes, .	1
Short bass,	2
Possession of seed lobsters,	1
Short pickerel,	3
Sale of game birds,	5
Smelts in close season,	1
Using ferret,	6
Killing game with ferret,	1

While the foregoing chapters indicate that it is not the sole function of this commission to enforce the fish and game laws, reference to the above table indicates in part the substantial progress which our deputies are making in protecting public property. Notwithstanding the practice of the deputies to show leniency to such persons as may unintentionally violate the law, — and many first offenders have been merely warned, — the total number of persons arrested is 54, or 15 per cent. larger, and the number of cases discharged is 11 less, than in the previous year. The percentage of offenders of foreign birth (judging by name) is reduced nearly one-half. This appears to be referable directly to the license law for alien foreign-born hunters.

This indicates, not that there has been a greater number of offenders this year, but that the laws have been more satisfactorily enforced. The smaller number of cases discharged indicates an increased efficiency in the personnel of the paid deputy force, and improved judgment in making arrests and prosecutions. The results are creditable when it is noted that only in rare cases is the Commonwealth represented by a law-

yer. In nearly every case the deputy is compelled to act as complainant and as the prosecutor, managing the case and making the plea for the Commonwealth.

The paid deputies, in addition to detective and on occasions athletic abilities, are required to have an extensive first-hand knowledge of the woods and streams, and a rather close acquaintance with the habits of all those creatures, both fish, flesh, fowl and hunter, law-abiding or lawless, which frequent these often remote regions. In addition to the above qualifications, he must be a keen and careful observer, capable of drawing correct inferences from his observations; he must be courteous, cool and quick-witted, swift and accurate, judicial and judicious; exposed to temptation of all sorts, he must remain impregnable. His bodily and mental vigor must carry him through night watches in the woods or by the waters. His is a daily task; the Sabbath is usually his "busy day," on account of the Sunday gunners. In all seasons the woods and ponds must be visited, and the well-being of their denizens considered. The most advantageous places for introducing trout fry must be recognized and remembered. Places where fry and fingerling fish have been introduced must be frequently visited to note the results. He must know the best methods of transporting live fish and animals. Above all, he must be truthful, of transparent honesty, and singleness of purpose to advance the best interests of the public. It is seen that the enforcement of the fish and game laws requires a specialized type of man. We believe that each year marks progress in securing such men.

In practical working the active force consists of sixteen paid men, who work usually in pairs, under directions from this office. Each man makes a daily report of his movements and observations. As the paid force has developed in effectiveness and numbers, the unpaid force has been gradually reduced. By this means the grave criticism to which the fish and game laws are subject, namely, the fact that one-half the fine goes to the complainant, thereby sometimes arousing improper motives for prosecution, can be minimized through the restriction of the appointment of unpaid deputies to men of proved probity of character and mature judgment. By the system of

paid deputies all the fines imposed are turned into the treasury of the Commonwealth; there is no incentive to prosecute for the sake of the fine. This leads to a more satisfactory public spirit and respect for law. It develops greater responsibility on the part of the deputy, and more complete control over the actions of the deputies by the commissioners. It develops an *esprit de corps* which wonderfully increases the law-enforcing efficiency of the department.

The following report of Deputy Shea indicates the attitude of the paid deputies towards the work entrusted to them:—

To the Commissioners on Fisheries and Game, Boston, Mass.

GENTLEMEN:— I have enforced the law in this and other sections of the State where I have been sent, to the best of my ability, my aim being to enforce the law without spite or prejudice, deal sharply with wilful lawbreakers but leniently with ignorant and unintentional violators, and squarely with all. I find such a course has engendered a better feeling among the sportsmen in the forty or fifty different cities and towns which I have visited the past year on official business. In my estimation a great deal of good has resulted from the enforcement of present laws, the public generally favoring them and desiring a sane enforcement of them.

Deer have been more numerous this year than ever. There is not a locality which I have visited where deer have not been seen, and the farmers in this vicinity report seeing as many as six at one time in their fields. No doubt they are rapidly increasing.

The past year has been a record-breaker for woodcock, and I can truthfully say that woodcock have been found in greater numbers this season than for ten years past.

Quail have been scarce, due to the extremely cold weather of the past two years. I have seen but five flocks, and three of them were fed and cared for by me through the winter preceding.

Partridge shooting in this section of the State this season was considered the best for five years. Some fine bags were taken out of the covers, and I beg leave to call the attention of the Board to a few of the several remarkable captures which were made in this section during the open season. William Strain of Ware and Thomas F. Horrigan of Brighton bagged 14 partridges and woodcock in seven hours; Mr. Strain himself killed 44 in seven days' hunting. John A. Davis of Ware killed over 70 partridges in two weeks. C. H. Sawyer of Northampton, who is president of the Northampton Rod and Gun Club, reports that two hunters in that city killed 34 birds, partridge and woodcock, in one day. William Cummings of Ware killed 17 birds, partridge and woodcock, in one day's shooting. Such hunting tends to show the increase of birds since last season. With a little protection, the large number of birds left over from the season just closed, if there is a good hatching season, warrant the belief that birds will be found in abundance at the

opening of the season of 1906. Small game, including rabbits and gray squirrels, have increased wonderfully in this section in the past five years. Song and insectivorous birds are increasing yearly, but pheasants are very scarce in this section.

Trout fishing during the past year has been particularly satisfactory, especially in the central and western sections of the State. Large fish and plenty of them have been taken, which shows that stocking the streams with fry and fingerlings year after year by the commission has not been a waste of time or money. In this connection I beg to call the attention of the Board to a few of several remarkable catches of trout in the town of Ware, Hampshire County. T. F. Horrigan of Brighton, in one day's fishing, took 31 trout from Ware waters, the largest weighing 2 pounds. E. W. Lawton of Ware took 5 trout, weighing 6 pounds. The writer caught 12 trout, weighing 7 pounds dressed, in the Barnes Brook one afternoon. These catches show the grand results obtained by continued re-stocking of the streams.

From several years' experience in field work, and after careful consideration and study of the question, I respectfully submit that there is need of a law which will give the paid deputies a right to detain any suspected person found in the woods hunting or on a trout stream fishing, who refuses to show what he has killed, and bring him to the nearest police station and there search him, without the deputy laying himself liable.

There is also need of a law to limit the hunter's bag to a reasonable number of partridges in one day; and the law should provide that the possession of more than the allowed number at one time would be *prima facie* evidence to convict. For the privilege of hunting in this State non-residents should be made to pay a license fee of \$10.

Respectfully,

DENNIS F. SHEA,

Deputy.

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Purposes of the Game Laws. — It is beyond all reason to expect that in general game laws, however well enforced, can restore in a generation the abuses which have been practised upon game and useful birds since the settlement of the country. In spite of the close-season law and other restrictions, which were first enacted in the colonies in 1709, upon hunting turkeys, heath hens (later named pinnated grouse), ruffed grouse, quail and woodcock, the last wild turkey has long since been killed; the heath hen or pinnated grouse, which formerly inhabited the scrub oak tracks of southern New England and sections of western New York State and southerly to Virginia, have become restricted to a small area in Massachusetts of less than 25 square miles; the woodcock is dangerously near the verge of extinction; the quail and ruffed grouse have decreased alarmingly in numbers, and their range is becoming restricted in all the States.

The game laws of this country are based upon the principle that the wild fish, birds and mammals are property of the State. This is now a well-recognized principle, and is the basis of any law which State and national legislative bodies may make in exercise of their police power of protection to the property of the State and nation. The principle has been sustained by the highest courts, including the Supreme Court of the United States.

In many cases severe penalties have been imposed for the purpose of definitely calling attention to the importance of properly protecting birds. In New Jersey during 1904 eighteen sentences of imprisonment were imposed. The shortest was ten days for killing a snow bird, and the longest was ninety days for killing two robins. While these laws and the enforcement of them are of direct benefit to farmers and other citizens of rural and suburban districts, the urban dweller also shares the benefits. The cost to farmers of controlling weeds and injurious insects in Massachusetts is annually a very large sum in direct expenditures for labor and for materials necessary to protect the crops. In spite of this expenditure, the annual damage to the growth of crops by insects must be estimated at not less than \$4,000,000. All this must be figured in the cost of production, and therefore actually determines the average selling price of practically all agricultural produce. Apples cost in the market 50 cents per barrel more if the grower is compelled to pay 50 cents per tree to kill tent caterpillars, apple maggots and codling moths, because a neighbor, a stranger or a cat kills the cuckoos, the vireos, the night hawks, whip-poor-wills, bluebirds, wrens, etc. The quail or "bob-white," which has been carefully studied by the late S. D. Judd, when assistant of the United States Biological Survey, was estimated to consume annually in Virginia and North Carolina 1,341 tons of weed seeds and 340 tons of insects. The quail feeds directly in our cultivated fields, and the insect food is largely made up of the Colorado potato beetle, cutworms, army worms and similar farm pests; and it is therefore one of our most valuable birds, and one worthy of serious attempts at domestication.

Obstacles to Enforcement of Game Laws.

SEEK DEER HUNTERS. — SQUAD OF FISH AND GAME WARDENS IN WOODS ABOUT BUZZARDS BAY AND SANDWICH.

Buzzards Bay, Nov. 21, 1905. A squad of fish and game wardens are searching the woods about here and at Sandwich for violators of the game laws. The wardens are watching for persons who they believe are illegally shooting deer. Deer are very plentiful, and many are believed to be from the game preserve on Naushon Island in Vineyard Sound. It is unlawful to kill deer here at any time. All the members of the squad except Warden Mecarta of Harwich are strangers here. Game wardens who have visited this region in the past in quest of violators of the game laws have never been successful. ("Boston Globe.")

Statements like the foregoing are not the least of the difficulties which our deputies are compelled to work against. Through such an item the violators or their "accomplices after the deed" are almost certain to be warned, and the work of the deputies must be repeated.

Another sort of person with whom the deputies have to deal is the type which "wishes to be solid with both parties," — who in one breath furnishes evidence that a State law is being violated, the people's lawful property unlawfully destroyed, and immediately hastens to this professional violator and tells him that the deputies are on his track. As we have said before, a finer public conscience should be trained to meet this problem of the violations and enforcement of the fish and game laws. We can safely promise the citizens that the authority entrusted to this commission shall not be used to persecute the unwitting or ignorant violator of the laws. The boy with a short lobster or a short trout, or the sportsman or recreationist with a trout or two "just a leetle short of the legal size," is not the type of violation with which our deputies concern themselves. They seek the professional violators, the sellers of partridge and woodcock, and the type of "sportsman" (?) who goes for a record, killing every fish or bird, whatever its size or species, because it counts one in the story which he rehearses to himself before he vaingloriously retails it to his admiring (?) listeners.

In enforcing the law our deputies do not seek to secure "a record" of an aggregate sum of convictions or of fines imposed.

In many cases of a first offence a warning is given in unmistakable terms; on the second offence the law is permitted to take its course. We aim to deal with each individual or condition in such a manner as to teach the people to understand the purpose and the value of the law, rather than by harsh measures arouse opposition or do injustice to an unintentional offender, in a case where milder treatment might have secured equal respect for the law.

The following report from Deputy Burney details some of the obstacles with which our deputies are able to cope successfully:—

Saturday at 2 P.M., Jan. 14, 1905, I received a complaint from Georgetown that a deer had been killed in that town. I started from Lynn on the 3.16 train, arriving at Georgetown about 4.30. I met the chief of police (who was the complainant) at the depot, and after hearing his story I saw we had a pretty good case to work on, and immediately got out a search warrant. Realizing that we could not search a dwelling house under our warrant, we drove to Newbury and saw the meat inspector and told him our story. He said he would try to get a warrant to search for uninspected meat. We then drove to Haverhill and saw the clerk of court, who, after listening to our story, refused us a warrant. We then drove to South Groveland, where the suspected parties lived, arriving there about 11.15 P.M. Going to the house of Mr. B. (who was the suspected party), we found in the bushes the sled upon which the deer had been dragged from the woods. There were blood and hair on the sled, and the hair I *knew* was from a deer. Going back to the house we knocked at the door, and Mr. B., Sr., came to the door. We told him who we were, and that we wanted the deer that had been killed near by and dragged to his house on the sled which we found in the bushes. He denied any knowledge of it, adding that if we thought it was in his house we might come in and search, which offer we availed ourselves of at once. We found nothing on the lower floor, and, as the two women of the house had gone upstairs (as we supposed, to retire), we did not search the upper part of the house. We then went outside and looked over the woodshed. We knocked off a bulkhead door to the cellar of the shed, when I crawled under on my hands and knees. That part of the shed was filled with stove wood, and I found no sign of deer meat. I also looked all around the building, and found no signs there. Next we took the back track of the sled into the woods, thinking they might have hung the deer up somewhere in the thick woods, where it would not be seen. We went back more than a mile on that track and found only one sled track, showing that the sled had been carried on some one's back while going from the house. We found also several places where the deer had fallen off the sled, and the snow all trodden down and bloody. Coming back to the house, we went all around the clearing near the house, but found

nothing. When we got to the house the man who was with me went into the house to get warm. I took the lantern then for another look around. Going by one of the windows in the rear of the house I found some blood marks on the snow. Looking further, I found a small piece of deer meat and blood marks leading to the woodshed door, which had been nailed up again. *I knew those marks were not there when we first looked around there.* Going into the house after the axe to rip off the door, Mr. B. asked me, "What do you want it for?" I told him I had enough evidence to lock him up, and if he did not show me where that meat was, I would do so at once. Then I told him I was going to open that door again. He came out with me, and when he saw me start to break the door off he said the meat was in there, and had been there all the time, — which was a lie, as two of us looked that place all over. When I got the door off I found the meat, and it was wrapped up in a sheet, — convincing proof that the meat was upstairs in one of the bedrooms, and, while two of us were out in the woods looking for it, it was thrown out of the window by Mrs. B. and put into the woodshed (where we had searched before) by Mr. B., as the chief of police, who had been left in the house, said he went out while we were in the woods.

B. said he intended to burn it, as he knew it was wrong to kill a deer in Massachusetts; but he said *he did not kill it.* I told him it made no difference, as I was going to lock him up. Just as I finished my statement, young Mr. B. spoke up and said *he* killed the deer. As he and his father said he would be at court at Haverhill the following Monday, I did not arrest him. He appeared at the time stated, was convicted, and fined one hundred dollars. Failing to pay, he was committed to the House of Correction for two months.

As to the elder B.'s statement of his intention to burn the meat, I found where he had purchased two empty butter firkins and a peck of coarse-fine salt. Of course he intended to burn that with the deer!

On this trip we were out from 4.30 P.M. Saturday to 4.30 A.M. Sunday, and it was the coldest night of the season. The thermometer registered 14 degrees below zero Sunday morning, when we got back to Georgetown.

Deer. — Wellesley, Nov. 28, 1905. On the estate of Charles B. Dana, off Grove Street, in the outskirts of this town, a full grown deer was seen grazing about the frost-nipped fields this afternoon. The deer had a magnificent set of antlers. The animal appeared well fed, and had evidently found browsing in this vicinity profitable. The deer wandered contentedly about the field for half an hour, when he became frightened and made off into the Ridge Hill woods. Earlier in the afternoon a small doe was seen on the Cartwright estate, off from the Dana fields. The doe wandered about the fields and underbrush for some time, nibbling at the twigs and nosing about the underbrush. When boys gave chase to the doe it made into the Ridge Hill woods near the same place where the larger animal went soon afterwards. It is believed here that the two animals wandered down into the wooded sections of this town from Maine or New Hampshire woods, as two such animals are not known to be missing from any parks anywhere in

this vicinity. Residents of Cartwright Street report that the larger animal, or one closely resembling it, was seen browsing about the fields in the Dana place one afternoon about a fortnight ago.

The above paragraph fairly represents the general idea that deer are uncommon animals in Massachusetts, and when they appear are to be regarded as stray animals. Ten years ago deer were indeed rare, but under the present law, which forbids the hunting, chasing, wounding or injuring of a deer, or possession of a deer killed in Massachusetts, they have multiplied with amazing rapidity. They are reported from all sections of the State, though naturally they are most numerous in the western half of the State. An estimate based upon reports sent into the office by our deputies places the total number of wild deer in the State at upwards of 5,000.

The public should be duly warned that it is contrary to law to chase a deer; and it has proved to be a costly experience for three young men in Lynn, who chased a deer which had wandered into the city and become confused.

Considerable numbers of deer are killed by locomotives, trolley cars, etc., by being chased by dogs, and by hunters.

The most notable seizure of game ever made in this State was the carload of game which was shipped from Maine as "household furniture." On its arrival in Boston it was seized by this commission. The owners did not care to claim it, and the entire lot, consisting of 12 deer, weighing 1,525 pounds, 4 hind saddles of deer, weighing 240 pounds, 2 hindquarters of moose, and 6 bags containing 165 ruffed grouse, was disposed of in accordance with the decree of the court.

Killing of Birds for Millinery Purposes.—Early in the year it came to the notice of the commissioners that large numbers of birds which are very properly protected by law in this Commonwealth and in other States were being sold for millinery purposes. In Taunton, Fall River and New Bedford even an incomplete investigation disclosed upwards of 2,000 wild birds or parts thereof which had been prepared and placed on sale for millinery purposes. The following notice was then sent to the prominent wholesale and retail milliners of Massachusetts:—

DEPARTMENT OF FISHERIES AND GAME, BOSTON, MASS.

I beg to call your attention to our State laws covering the possession or wearing, for the purpose of dress or ornament, the body or feathers of insectivorous and wild birds, whether taken in this Commonwealth or elsewhere. This law covers the skins and feathers or parts thereof especially of insectivorous birds, herons (aigrettes), gulls, terns, shore birds, etc., "whenever and wherever taken." We respectfully suggest that you can best observe the spirit and letter of the law by removing from sale all such feathers, and returning them to the wholesalers; and, further, by refusing to buy or sell such feathers, aigrettes, etc. Certain dealers are claiming that the bird laws are not to be enforced, or that their particular goods, notably aigrettes, are manufactured, and therefore not prohibited by this law. In case such statements are made, the writer will be glad to give an opinion as to whether any particular feathers come within the scope of the law, and whether such are liable to seizure and the possessor liable to arrest.

The State authorities entrusted with the protection of bird life wish to secure results with the least possible hardship to the public and the "trade," and therefore ask your co-operation.

In any event, however, we beg to formally notify you that we shall use every legitimate means to enforce the laws of the Commonwealth, and all persons having such birds and feathers in possession, whether as dealers or wearers, are liable to arrest.

Respectfully yours,

G. W. FIELD,
Chairman.

A special deputy has during the year visited the millinery stores throughout the State, and secured definite promises from the owners and managers to abstain from the display and sale of such feathers. In general the most cordial good-will and respect for the law, as well as a strong appreciation of the motives and necessity, together with a good knowledge of the scope of the law for the protection of birds, were reported. Thus far it has been necessary for our deputies to confiscate but two lots of such illegal feathers. Many lots have been returned to the wholesalers; a larger number have been burned or otherwise destroyed by the owners. A very considerable quantity have been "put away" by millinery houses to await the time when "the excitement blows over." Inasmuch as sufficient time has been given to permit those who were unwittingly violating the feather law to dispose of such illegal possessions, our deputies have been instructed to watch carefully for all violations, and if necessary proceed with the confiscations and prosecutions.

Additional facts concerning the magnitude of the crimes committed by feather hunters can be gathered from the following extracts from "Bird Lore," January-February, 1905:—

Midway Island at the time of my visit in 1902 was covered with great heaps of albatross carcasses, which a crew of poachers had left to rot on the ground after the quill feathers had been pulled out of each bird. This mischief was done notwithstanding the fact that the previous year a similar party had been warned off by the United States steamer "Iroquois," which visited the island by chance.

Honolulu, June 23. Captain Hamlet of the "Thetis" states that the destruction wrought to bird life by the party of Japanese poachers on Lisiansky Island was something appalling. He estimates that they killed at least 300,000 birds, to judge from the number of cases of plumage and the amount of meat they secured. All of their spoil had to be abandoned, but it is properly preserved, and will keep for a long time. There are 335 of these cases, the plumage in them being of the highest quality.

Early during the present year large numbers of swallow skins were offered in the millinery shops in New York. On examination they were found to be *Hirundo rustica*, a common European bird. Some were purchased and sent to the British society, in order to keep them informed of the situation in the United States. The secretary replied: "Your enclosure is of melancholy interest,—the poor little bodies of these young swallows, killed when just out of babyhood, and making, probably, their first flight to a new and unknown home,—swallows that ought to have come and twittered about our English homes, but instead are ghastly little corpses for the 'decoration' of American women's hats.

"I think I may say that in England the swallows are everywhere protected and valued. I doubt whether one is ever intentionally killed. On the contrary, the decrease in their numbers has of recent years been a subject of serious concern. It is on the Mediterranean, in France and Italy, that the slaughter of these birds takes place during the migration season; and this I fear we shall have no power to stop until some international law of bird protection is agreed upon."

Sunday Hunting.—In rare instances a judge may hold that no intent to violate this law is shown when a man is on the hunting grounds with a loaded gun; but except in isolated instances, such presence on the hunting grounds with a loaded gun, even if it is not discharged at birds or game, is sufficient for conviction. Sunday hunting is still prevalent in those sections which are as yet insufficiently patrolled, owing to the small number of paid deputies.

Smelt Seining.—During the smelt season, particularly during the spawning period, particular attention and much time

is devoted to the protection of smelts. We receive many complaints of seining, but they are usually found to be ill-founded. This sort of detective work is very trying and dangerous to the health of a person, for the seining is done at night, and one must lie among the bushes or trees on the bank of a brook, or among the rocks on the shore, for several nights, waiting for these violators to come with their seine or net. Without the seine or net we are unable to get a conviction, though we produce the smelts in court without a hook mark on them. There are several hundred fishermen who go about at night seining or torching herring and whiting; these men get some smelts; they seldom return them to the water, for they use a dip net, and must work quickly while the fish school under the light which projects from the bow of the boat. When they finish dipping, the smelts are dead, and it would be useless to return them to the water. Some provision should be made to regulate this industry, as it is very profitable, and increasing yearly. This has been an unusually good smelt season.

Work of the "Scoter." — The launch "Scoter," under the able and honest management of deputies Killion and Serrilla, has continued to do efficient work in preventing the killing of short lobsters. In addition, they have done much to protect the fishermen from thieves who illegally haul lobster pots, and to check Sunday shooting.

To the Commissioners on Fisheries and Game, State House, Boston, Mass.

DEAR SIR: — I herewith submit my report for the year ending Nov. 20, 1905: —

During the winter and early spring much of my time is spent at the dealers in and about Boston, inspecting Nova Scotia lobsters, to see that no short lobsters are saved with the large, as the fishermen sometimes put in short ones, thinking they will escape the attention of the deputies. There are several dealers here who write weekly to their fishermen not to "mix the shorts," and these dealers render all possible assistance to stop the short lobster traffic. There were fewer shorts this year than last. I inspected about 6,500 crates of lobsters, and found about 8,000 shorts, which were put into Boston harbor. There are also shipped through this port to New York, Rhode Island and other States many crates of short lobsters, which, were the deputies not on hand, would remain here in Boston and be sold as meat. Also during this season I kept careful watch of the markets in and about Boston, to see that the law was not violated.

We put the launch "Scoter" in commission in April, and during the

native lobster season we patrol the harbor and coast in the vicinity of Boston, protecting the lobsters.

That our previous seasons were a success is shown by the reports of the honest fishermen in and about Boston. It is impossible to give the exact figures on how many shorts are returned by the fishermen, because of the "Scoter" being on the fishing grounds while they hauled their traps, but we can give an estimate. On April 26, while on the fishing grounds, we counted 1,500 shorts returned by fishermen, one man throwing overboard a bag of shorts. During the month we estimate 57,000 shorts were returned by the fishermen. During May the catch of large lobsters was very good, and some of the fishermen report the best spring for ten years.

We searched many boats, and liberated several hundred shorts in sunken traps, which latter we confiscated; in one haul we got 850 shorts. The estimate of May is 60,000 shorts returned. June was a very good month; estimate 90,000. In July we searched many boats in and about the harbor; we hauled a great many sunken pots, and got over 3,000 shorts.

On July 5 we counted the shorts which 2 fishermen returned while they hauled, and the average was 4 to a pot. In that vicinity there were 15 fishermen, and each had about 100 pots there, which would show that they returned, on that day, 6,000 shorts in that part of the harbor. There are about 150 fishermen in and about Boston harbor, and it is safe to estimate that on that day in all the harbor we caused, by our presence among the fishermen, more than 20,000 shorts to be returned.

During July we estimated 175,000 shorts returned. August was a fairly good month for the fishermen. We got 1,500 shorts in blind traps, and estimate 140,000 shorts returned.

September was a very good month for lobsters, but many pots were lost by the storms. During the month we estimate 140,000 shorts returned.

The fishing during October and up to November 20 was very good, and the shorts were as plentiful as during the summer; we estimate 147,000 returned. After this month many of the fishermen take in their traps.

During November there was a great plenty of shorts outside Boston Light, but very few of the fishermen care to go there, as it is very rough, and small boats are not safe. We can say that by our presence on the fishing grounds and about the harbor and vicinity 900,000 short lobsters were returned by the fishermen, which otherwise would have been destroyed and sold for meat. Surely some of these lobsters were caught over and over again; but if the deputies were not there, or were not expected by the pirate fishermen, the lobsters on Massachusetts coast would soon be wiped out. For this reason all honest fishermen are in favor of having more boats to patrol the coast from New Hampshire to Rhode Island.

On one part of the coast the fishermen have adopted a very good method of stopping the saving of short lobsters. If a fisherman is seen saving any shorts, some of the other fishermen cut the buoys from

his traps, and he soon learns that it is cheaper to stop saving shorts than it is to buy traps. This is a very good custom, but there are several ways which if applied would save this best of all crustaceans.

Four boats patrolling the coast would, I believe, be the best way possible, — one to patrol from New Hampshire line to Lynn, one from Lynn to Scituate, one from Scituate down the South Shore, and the other at Buzzards Bay.

This not only would save the lobsters, but would protect all fish and stop all Sunday hunting along the coast. The passage of a meat law and license law would be an excellent way of putting a stop to this unlawful practice.

Under the present law, the fisherman who is caught goes to court, and after the case is disposed of goes out to save more shorts to pay for the fine imposed, whereas, if he knew he was liable to be sent to jail for a period of one month or more, he would not care to take the chance of getting caught by saving any more lobsters.

Therefore, I would suggest that a penalty of imprisonment be added to the law now in force, from one month to a year for having in possession short lobsters. A fisherman who is caught with more than a hundred shorts is dealt with more leniently than the man with a dozen or less, though he is the greater violator. A man with 10 lobsters is fined \$2, \$3 or \$5 apiece; the man with 75 or more is fined \$1 or less apiece. Now, if the court had the right to send a man to jail, the man with the 75 lobsters might be fined \$5 apiece, and if he wouldn't pay, the court under the proposed amendment to the law could sentence the offender to jail.

It is during the summer season, when the shore hotels and restaurants are open, that the short lobster is used on this coast. These lobsters are supplied by men who have fast naphtha boats, and who purchase the shorts from the fishermen at 4 cents apiece. They usually work at night and we are unable with one boat to chase up and down the coast after these men. While we are at the South Shore these men are on the North Shore; and if we neglect the harbor at Boston for any length of time, the fishermen there save the shorts and dispose of them to pleasure parties on yachts and boats.

We have been able to make these dealers in short lobsters throw overboard the lobsters which they had, but have never been able to catch them, as they can see the "Scoter" coming, and before we get to them the lobsters are gone; we search the boat, and find no short lobsters.

I have been sent to different parts of the State in discharge of my duty, and hear very good reports of game and fish. We also are active while about the harbor endeavoring to put a stop to Sunday hunting and shooting from power boats. This year the wild fowl and shore birds were very plentiful, and I learn from very good authority that it was the best season for many years. I never saw so many of the duck species as this year, and this fact only adds to the temptation of Sunday hunting and hunting from power boats.

Very respectfully yours,

DANIEL J. KILLION,

Deputy, in charge of launch "Scoter."

NEW LEGISLATION.

We especially recommend the following changes in the fish and game laws:—

The amendment of section 84 of chapter 91 of the Revised Laws, by the addition of the following words: *for the purposes of this section a seed scallop shall be defined as a scallop which has never laid eggs, or a scallop which was hatched from an egg laid during the summer previous to time of taking*, so as to read as follows:—

Whoever takes seed scallops from the flats or waters of the Commonwealth shall be punished by a fine of not less than twenty nor more than fifty dollars for each offence; but such penalty shall not be incurred by any person taking such scallops who returns them alive to the flats or waters from which they were taken. For the purposes of this section a seed scallop shall be defined as a scallop which has never laid eggs, or a scallop which was hatched from an egg laid during the summer previous to time of taking.

Measurements of upwards of 35,000 seed and adult scallops in Chatham, Edgartown and Nantucket indicated that a size limit of 2 inches in diameter measured on a straight line drawn from the outside edge of the scallop perpendicular to the middle point of the outside line of the hinge would be the most satisfactory definition of a seed scallop.

More satisfactory provision should be made for legitimately securing shiners for use as bait. The following is therefore recommended:—

It shall be lawful to take shiners for bait in any of the waters of the Commonwealth by means of a circular or hoop net of a diameter of not exceeding six feet or by means of a rectangular net other than a seine containing not over thirty-six square feet of net surface.

The provisions of section twenty-six of chapter ninety-one of the Revised Laws, as amended by acts of nineteen hundred and four, chapter three hundred and eight, and of section one hundred thirty-two of said chapter ninety-one, shall not apply to a person taking fish other than shiners by means of the apparatus described in section one, provided that the said fish other than shiners are immediately returned alive to the water.

This act shall take effect upon its passage.

On account of the barbarous destruction of certain fish during the breeding period, we urge the passage of an act to

prevent the destruction of pike perch during the spawning season: —

SECTION 1. No person shall kill within this commonwealth, between the first day of February and the first day of June in any year, any fish known as pike-perch; and no company, firm or person shall transport into or within this commonwealth any of the said fish caught between the said dates, wherever the same were caught.

SECTION 2. The commissioners on fisheries and game and their deputies are hereby authorized to seize and confiscate fish killed or transported in violation of the preceding section, and it shall be the duty of every officer designated in section four of chapter ninety-one of the Revised Laws to seize fish so killed or transported, and to report the seizure to the said commissioners, who shall authorize the sale of such fish; and the proceeds of any such sale, after paying the expenses of the sale, shall be paid into the treasury of the commonwealth.

SECTION 3. Any company, firm or person violating the provisions of this act shall be liable to a penalty of fifty dollars, and of ten dollars additional for each fish killed or transported in violation of the provisions of this act.

SECTION 4. This act shall take effect upon its passage.

For the purpose of safeguarding the public health, and for restricting the extensive evasion of the present lobster laws, we recommend the enactment of a law prohibiting the sale of lobster meat after removal from the shell, as follows: —

All lobsters or parts of lobsters sold for use in this state or for export therefrom, must be sold and delivered in the shell, under a penalty of twenty dollars for each offence; and whoever ships, buys, sells, gives away or exposes for sale lobster meat after the same shall have been taken from the shell shall be liable to a penalty of one dollar for each pound of meat so bought, sold, exposed for sale, given away or shipped. Any person or corporation in the business of a common carrier of merchandise who shall knowingly carry or transport from place to place lobster meat after the same shall have been taken from the shell shall be liable to a penalty of fifty dollars upon each conviction thereof. All lobster meat so illegally bought, shipped, sold, given away, exposed for sale or transported shall be liable for seizure, and may be confiscated. Nothing contained herein shall be held to prohibit the sale of lobsters that are legally canned.

The above is practically a verbatim copy of the law in force in Maine. It has proved to be very satisfactory to all concerned. It works no inconvenience to the consumers of lobster salads, but compels the managers of hotels and summer resorts

to buy the lobsters in the shell, whereby some assurance may be obtained that the lobster had not died previous to boiling, and that the meat had not been unduly exposed to infection.

In view of the evidence that the present laws governing the lobster industry have proved inadequate to fulfill the purpose desired, we recommend a careful consideration and trial for a sufficient term of years of some practicable method of protecting the adult lobsters, in order that the number of breeding lobsters in the ocean may be increased.

An act suitable to check the enormous destruction of wild birds, both game and insect-eating, by cats, is urgently needed.

For the purpose of preventing the total extinction of one of the most interesting native birds, we urgently recommend a close season for at least five years upon pinnated grouse, with a fine of at least one hundred dollars, as follows:—

Whoever hunts, takes, kills or has at any time in his possession, or buys or sells or otherwise disposes of a pinnated grouse, or heath hen, so-called, scientifically known as *Tympanuchus cupido*, or any part thereof, previous to November one, nineteen hundred and eleven, shall be punished by a fine of one hundred dollars for each bird or part thereof.

Section four, chapter ninety-two of the Revised Laws, is hereby amended by the omission of the words “a pinnated grouse at any time or” in the first line.

This act shall take effect upon its passage.

Also the prohibition of the sale of prairie chickens and of quail (*Colinus virginianus*), or any part thereof, whenever or wherever taken, except for purposes of propagation, as provided in section 3, chapter 92 of the Revised Laws.

The snaring of ruffed grouse should be totally prohibited.

The wood or summer duck should be placed upon the list of birds which may not be killed at any time.

The commissioners urgently recommend consideration of the benefits accruing to all from having open seasons for game uniform throughout the State, both as to localities and as to the different species of game birds and animals.

In regard to the shooting of pheasants the following is recommended, giving an open season on male pheasants during the open season for quail:—

It shall be unlawful to take, kill, sell or have in possession except for purposes of propagation, a male Mongolian, ring-neck or English pheasant between the first day of December and the first day of November following, or to take, kill, sell or have in possession except for the purpose of propagation, a female bird of the said varieties at any time, under a penalty of not more than twenty dollars for each bird or part thereof. Possession of a dead pheasant during the time when the taking or killing is prohibited shall be prima facie evidence that the person having possession has violated some of the provisions of this chapter.

We earnestly urge the abolition of spring shooting, in the belief that such action will result in the nesting within the State of an increased number of migratory birds. The experience of other States indicates a large increase in the number of migratory shore and marsh birds, ducks, etc., which remain to breed in States where spring shooting is no longer practised.

A shortening of the season on hares, rabbits and squirrels, for the well-known reason that many quail and ruffed and pin-nated grouse are illegally shot by "rabbit hunters."

We recommend that section 5 of chapter 92 of the Revised Laws, as amended by the Acts of the year 1905, chapter 414, be further amended by the omission of the following words at the end of the section: *but the provisions of this section shall not apply to the great American herring gull, nor to the great black-backed gull between the first day of November and the first day of May following.*

The enactment of a law for the further protection of wild birds and mammals, by giving additional powers to the commissioners and their deputies:—

A commissioner on fisheries and game, or any duly authorized deputy thereof, may demand of any person who is, in the opinion of such commissioner or deputy, engaged in the taking, killing, hunting, trapping or snaring of fish, birds or mammals contrary to law, that such person shall forthwith display for the inspection of such commissioner or deputy any and all fish, birds or animals then in his possession; and the refusal to comply with such demand shall be prima facie evidence that the person so refusing is engaged in the taking, killing, hunting, trapping or snaring of fish, birds or animals in violation of law. The said commissioners and their deputies may call upon any person or persons in the name of the commonwealth to assist them in the execution of their duty in the enforcement of the fish and game laws; and whoever, being so required, neglects or refuses such assistance shall be punished by imprisonment for not more than one month or by a fine of not more than fifty dollars.

This act shall take effect upon its passage.

In this connection it may not be out of place to note that the following States grant their deputies or wardens right to search with and without a warrant: Maine, Connecticut, Vermont, Washington, Illinois, Pennsylvania, Iowa, Colorado and Michigan; while other States, *e.g.*, New York and New Jersey, give specific permission to search game bags, coats and fish baskets.

The enactment of a law relating to ferrets:—

Owners or possessors of ferrets shall notify in writing the commissioners on fisheries and game of the fact that one or more ferrets are in possession. The owners or possessors of such ferret shall, under a penalty of ten dollars, also notify in writing the commissioners on the day that a ferret or ferrets leave the possession of the former owner or possessor, and shall at the same time give the name of the owner or possessor into whose possession the ferret passes. Ferrets which are not thus accounted for are liable to confiscation, and the possessor liable to a fine of not exceeding ten dollars for each ferret in his possession.

COURTESIES.

It is our privilege and pleasure to acknowledge the courtesies extended to the commission by Mr. Arthur L. Millett, local agent of the United States Bureau of Fisheries at Gloucester, and by F. F. Dimick, secretary of the Boston Fish Bureau. Also by E. C. Watson, Esq., who so cordially extended to the chairman and to Commissioner Delano the privilege of the City Club of St. Johns, N. F., on the occasion of their visit to that city in October, 1905.

The officials of the Massachusetts Fish and Game Protective Association, particularly Messrs. C. W. Dimick and H. H. Kimball, have very kindly furnished us with opportunities to secure live quail for experiments in propagation.

In the complete absence of laboratory facilities, our biologist, Mr. Belding, was permitted during the winter months to make use of the equipment in the biological laboratories of the Massachusetts Institute of Technology, through the courtesy of Dr. W. T. Sedgwick, professor of biology. Professor Sedgwick, in a characteristic note, says: "The Institute is always happy to do anything it can for the State, as some slight return for the many things which the State has done and is doing for the Institute."

Permits to hold in confinement egg-bearing lobsters for collection by agents of this commission, according to chapter 408, Acts of 1904, were issued to 220 fishermen.

Permits for taking birds and eggs, under various restrictions and for scientific purposes only, under section 7, chapter 92 of the Revised Laws, as amended by chapter 287, Acts of 1903, were issued to the following persons:—

John H. Hardy, Jr., Boston.
 Frank S. Aiken, Fall River.
 Frederick E. Waterman, Fall River.
 Chester A. Reed, Worcester.
 Ulysse Buehler, Stockbridge.
 Robert O. Morris, Springfield.
 Fred H. Kennard, Brookline.
 John W. Bailey, Boston.
 George H. Avery, Easthampton.
 Alfred E. Preble, Wilmington.

A. C. Bent, Taunton.
 Owen Durfee, Fall River.
 Rufus Choate Currier, Newburyport.
 E. H. Forbush, Boston.
 Napoleon Letiecq, Worcester.
 Dr. A. H. Tuttle, Cambridge.
 S. A. Capron, Medford.
 Homer L. Bigelow, Boston.
 Haynes H. Chilson, Northampton.

During the past year permits were issued to the persons named below to hold in confinement quail for purposes of propagation, in accordance with section 3, chapter 92 of the Revised Laws, as amended by Acts of 1905, chapter 406:—

Gen. Adelbert Ames, Tewksbury.
 Edmond L. Sinnott, Bridgewater.

Eugene D. Whiting, Bridgewater.
 G. M. D. Gardinier, Wellfleet.

Permits for taking sand eels for bait, according to chapter 164, Acts of 1902, were issued to the following persons:—

Robert J. Sweeney, Salisbury.
 John F. Sweeney, Salisbury.
 Paul Jones Lowell, Newburyport.
 Joseph Thurlow, Newburyport.
 William H. Simmons, Newburyport.
 Richard E. Pierce, Newburyport.
 Samuel P. Dow, Newburyport.
 E. L. Perkins, Newburyport.
 Charles F. Lattime, Newburyport.

Albion P. Hilton, Newburyport.
 C. A. Leet, Ipswich.
 S. W. Caswell, Ipswich.
 H. T. Mackinney, Ipswich.
 Edward E. Wells, Ipswich.
 James E. Carter, Ipswich.
 William Crooks, Newburyport.
 Charles A. Lunt, Rowley.
 James Crooks, Newburyport.

Permits were issued during the year to the persons named below to take and hold in confinement egg-bearing lobsters for fish-cultural purposes:—

E. F. Locke, United States Fisheries Station, Woods Hole.
 C. G. Corliss, United States Fisheries Station, Gloucester.

Permit to operate one pound net in the waters of Buzzards Bay was issued to:—

E. F. Locke, United States Fisheries Station, Woods Hole.

Permits to take lamprey eels for scientific purposes were issued to the following:—

William N. Holmes, Lawrence.

George M. Gray, Woods Hole (Marine Biological Laboratory).

A. J. Carlson, Chicago (University of Chicago).

Respectfully submitted,

GEORGE W. FIELD.

EDWARD A. BRACKETT.

JOHN W. DELANO.

REPORT OF THE COMMISSIONERS ON
FISHERIES AND GAME

UPON THE

DAMAGE CAUSED TO THE FISHERIES OF
MASSACHUSETTS BY DOGFISH

During the Year 1905.

REPORT

UPON THE

DAMAGE DONE BY DOGFISH TO THE FISHERIES OF MASSACHUSETTS.

To His Excellency the Governor and the Honorable Council.

SIR: — In accordance with chapter 12, Resolves of 1905, the Commissioners on Fisheries and Game respectfully submit the following report upon the damage done by dogfish to the fishing interests of Massachusetts.

The aim of the present investigation has been to arrive at accurate and judicial statements of actual, definite damage caused directly by dogfish. We have endeavored to take a wider range of view than that of the men whose property is almost daily destroyed, and whose hard-earned income is curtailed, by the ravages of the dogfish. Only passing references are here made to the serious indirect damage, such, for example, as the effect of dogfish in driving schools of bait fishes from our shores, and thus through the scarcity of fresh bait causing loss of time to the fishing vessels and crews. In a similar way there is some evidence that dogfish drive out of our bays and from our shores into deep water schools of herring, mackerel and other valuable fish, and thus may seriously affect our fishing interests. Of the verity of such conditions, however, there exists a very strong probability, yet it is not susceptible of actual and absolutely satisfactory proof.

SCOPE OF THE REPORT.

Your commissioners have, by personal observations and through the observations of specially appointed, accurate and trustworthy agents, secured a large quantity of reliable, first-

hand definite information and statistics upon the damage done by dogfish to fishing apparatus, such as nets, seines, trawls, hand lines, etc., to bait, and to fish caught on trawls or in nets; of "broken trips," due to the excessive number of dogfish on the fishing grounds; and, finally, have made examinations of the stomachs of dogfish, to determine the kind and quantity of food, hoping thereby to secure information upon the quantity of valuable food fishes destroyed by these sea wolves.

We have referred to some facts upon the economic value of the dogfish as a source of food, oil, fertilizer, "sand paper" and leather, for the purpose of stimulating the use of dogfish for commercial purposes, and thus in the largest possible measure checking the very serious economic mistake of killing many other species of fish and permitting the dogfish to escape. The fishermen are accustomed to release in the quickest way possible the dogfish which have been caught by hook or net. Only a comparatively small percentage is killed. It is a common source of amusement to fishermen to slash the body of the female dogfish, for the purpose of letting the unborn young escape into the water, "to see them swim." The tendency is to diminish the other species of fish by relentless killing of old and young, and to make no efforts to diminish the number of dogfish; consequently, the number of dogfish in proportion to the number of marketable fish is constantly increasing. Unless some definite and effective means are taken to kill every dogfish which is hooked or netted, the evil is bound to increase.

The question is a broad one, and passes beyond the limits of State or nation. The dogfish plague is now upon the fisheries of both sides of the North Atlantic, very seriously involving, in addition to the fisheries of Massachusetts and of the other New England and Middle Atlantic States, those of the Maritime Provinces of Canada, of Newfoundland, of Great Britain and Ireland, and of the other countries which fish in the North Atlantic Ocean, and the North Sea and its bays.

It is properly a subject for national consideration, for the reason that it is the general public — including the consumers, as well as the fishermen, dealers and distributors — which ultimately receives the benefit of the food fisheries; and it is this entire general public which suffers from any conditions which

tend to diminish the proper and normal yield of the fisheries, and to enhance the price of fish in the markets of the interior cities and towns, where marine fish, either fresh or salted, cured or otherwise prepared, are bought.

It has come to be a matter of common knowledge that the activities of civilized man have in many cases seriously disturbed the biological equilibrium. For example, by killing the hawks and owls, we have permitted the undue increase of the English sparrow; by killing our insectivorous birds, we have increased the burdens of taxation resulting from insect ravages, *e.g.*, the gypsy and brown-tail moth in Massachusetts, the grasshopper in the west, and the cotton boll weevil in the southern States. In a similar way we appear to have disturbed the equilibrium of the marine fishes. The people of the United States have drawn millions of wealth from the sea. There should be willingness to devote a small proportion of this to provide for a satisfactory maintenance of this source of wealth. The total catch of marine food fish in the New England States and Maritime Provinces was valued, in the hands of the fishermen, at upwards of \$20,000,000.

HABITS AND LIFE HISTORY.

The dogfish is too well known to necessitate a detailed description here. This name is a colloquial one, given to many species in different countries which may have no relationship to one another.

This report concerns only, and the term dogfish is here applied to, the two species of the shark family known as the "smooth dog" and the "spiny dog." The smooth dogfish (*Galeus canis*, Bonap., or *Mustelus canis*), which is common along the shores south of Cape Cod, is particularly destructive to small lobsters and other crustacea, and to some extent to shellfish. But the damage and annoyance from this species is very slight when compared with that from the spiny dog (*Squalus acanthias*, or *Acanthias vulgaris*), often called "picked dogfish" and "spiked dogfish," or "bone dog," on account of the characteristic sharp, stout spine or spike in front of each dorsal fin. The general aspect is that of a typical shark. The skin on the back and sides is an almost uniform slate color, ranging

to a brownish ash, with indefinite whitish spots, which gradually disappear as the fish grows older; the color of the under surface is a dirty white. A full-grown spiny dog weighs from 5 to 8 pounds, and is sometimes 5 feet long. The females are generally larger than the males of the same age. From their voracious and predaceous nature, and their habit of hunting in schools or packs, they are directly comparable to packs of wolves. They are notorious wanderers, and follow the schools of herring, shad, mackerel and other fish which come northward in the spring. They follow such schools into Canadian waters, but are checked by the proximity of ice; for the dogfish are naturally warm-water fish, and are most at home in or near the waters of the Gulf Stream, on the west and east sides of the Atlantic. Since they are such wide roamers, they rarely remain long in any one locality, though during the past ten years they have rarely been absent from some part of our coast, and the general testimony is that their stay upon these coasts has become prolonged to practically the entire summer. Professor Prince in this connection says:—

Like all the shark tribe, as already pointed out, the dogfishes are essentially wandering in their habits. They roam about in the most puzzling way. Here one day, gone the next; ever restless, and hastening from one area to another, stimulated by the wolf's love of "hunting," and driven no doubt by a voracious appetite to seek new supplies of food. They have been known to infest an extensive portion of coast for a few hours only, and then move on. In the Bay of Fundy the schools have usually made their appearance in the last season or two on or about July 18, and the coast was never free from them for six or eight weeks. In some places their sojourn was abnormally long, and off the Cape Breton shores they were never really absent for the long period of five months during the present year [1903].

A grain of comfort can be gathered from the fact that no one can foretell the date of the departure of these detested enemies to our fisheries. They come suddenly, and they depart suddenly. The causes can be surmised, but to most people they are a mystery. Their erratic appearance and disappearance has been noticed in various countries. It was well brought out in some of the evidence given before H. M. Trawling Commission, 1884, especially in that of Mr. J. Murray of Stonehaven, Scotland, who said, in the course of his remarks: "Of all fluctuations in the abundance or scarcity of any kind of sea fish on this coast, that of the common sea dog, or, as it is sometimes called, the English shark, is the most remarkable. About twenty or twenty-five years ago these fish resorted in enormous numbers to the east coast of Scotland. And yet, although the numbers of these fish had not been

reduced by either line, net or trawl fishing, still, they have almost completely disappeared from this coast, and no good reason has ever been assigned for their disappearance. If these dogfish had been of the same commercial importance as cod, ling, haddock, etc., their disappearance would have been a serious calamity to the fishing industry, whereas their continued absence is of the utmost advantage to the fisheries. That the sea abounds with life and living creatures is generally well understood; but the conditions of subsistence in the sea are frequently overlooked, viz., that all the larger fish exist by preying upon fish spawn and on their smaller neighbors, without much regard to species or variety. Fish are generally of cannibal habits, and by this seemingly wasteful arrangement of a natural law the prolific fecundity of sea fish is kept in due check, and the balance of ocean life is thereby maintained and perpetuated."

In my report [1898] on the "Fluctuations in the Abundance of Fish," I referred to the increased numbers of dogfish which between 1883 and 1893 frequented the Grand Manan and Passamaquoddy waters. I pointed out [p. 13]: "An increase in the number of sharks and dogfishes in a particular area may have the most baneful results, entailing not merely the wholesale slaughter of valuable fish, but their dispersion and flight to other areas, and frequently extensive injury to the nets and other fishing gear. Over thirty years ago, while mackerel were schooling in vast numbers in Massachusetts Bay, great schools of bluefish, 16 to 20 pounds weight, suddenly made an incursion, and devoured in quantity the smaller fish. The bluefish had been scarce for many years, and their unexpected advent had a most disastrous effect upon the mackerel fishery. Possibly a scarcity of food elsewhere had caused these larger fish to forage in this way."

The splendid fishing grounds off Grand Manan, N. B., deteriorated some years ago on account of the inroads made by sharks, dogfish, etc.; and in an official report [1893] the matter is stated as follows: "The decrease in the cod catch has been gradual for the last ten years, which can only be attributed to the marvellous increase in the schools of dogfish and sharks in the Bay of Fundy. The herring fishery is one-third less than last year, not from a scarcity of herring, but from the manner in which they have been harrassed by the dogfish, pollock and silver hake."

There are records that in 1729, and again in 1756, more than a quarter of a century later, the Welsh shores of Carnarvon and Anglesea were infested by great schools of the huge basking shark. For several seasons, about the two periods mentioned, they abounded in the warm mid-summer months, and about the month of October they disappeared. Pennant, the naturalist, writing in 1769, says that they had at that time entirely quitted the coast, — at any rate, scarcely more than a single one appeared along the coast referred to. Can it be that these schools had wandered from their accustomed grounds off the northwest coast of Ireland? In 1766 vast numbers of dogfish appeared along the east coast of England, but they remained outside the usual fishing limits of small boats, and interfered little with the in-shore operations. In December, when the haddock fishery was at its height, the fishermen secured large takes of haddock, small cobbles taking two tons a day;

but outside the 3-mile limit nothing could be caught but dogfish, with which the outer waters were alive. (Special reports by Prof. E. E. Prince, F.R.S., Canada, "The Dogfish Plague in Canada," 1903.)

FOOD.

In the preparation of this report we have examined the stomach contents of more than 674 dogfish which have been freshly caught. In most cases the stomach was filled with finely comminuted fish, apparently of valuable market species or of bait, and with nothing else; in two cases, however, the stomach contents appeared to consist solely of ctenophores (a small transparent, jelly-like animal, ovoidal in shape, best known for its beautiful display of phosphorescence). Dogfish caught on hand lines are most suitable for ascertaining the nature of the food. Those caught upon trawls usually have had a long waiting period, when practically nothing is possible except to digest the food already secured; such specimens are consequently of no value for this purpose.

BREEDING HABITS.

The dogfish has a manner of breeding which essentially resembles that of birds and mammals. The smooth dogfish lays eggs which when freshly laid and removed from the shell have a size and general appearance similar to the yolk of a hen's egg. The color, however, is faintly yellow or pale cream. The horny shell enclosing these eggs is soft, yellowish and semi-transparent when newly laid; in shape, something like a rectangular purse. From the four corners long, tendril-like projections extend, by means of which the eggs are anchored among the sea weeds at the bottom. As in the case of birds, the development of the young begins before the eggshell is formed, so that when the egg is laid the young fish is considerably developed. When the young fish is fully developed, and ready to hatch, the yolk has practically all disappeared, having been consumed by the growing embryo, which now pushes through the open end of the shell and escapes into the water. The empty, black, horny shells are driven ashore by storms, and blow about our beaches, where they are popularly known as "sailors' purses" or "mermaids' purses."

In the case of the spiny dogfish, however, such eggshells are

not formed, and the eggs are retained within the body of the mother until the development of the embryo is completed. At the time of hatching the young are from 5 to 6 inches long, and enter the water equipped with all the energy and ferocious instincts of the race. From 4 to 8 young are produced at a birth. The breeding process, as judged from the appearance of dissection, is a well-nigh continuous one. A female having young "pups" nearly ready for parturition usually has upwards of 4 eggs ready to take the place left by their predecessors as soon as these have been launched into the world. The spiny dogfish is said to bring forth from 10 to 20 young each year, but we are of the opinion that this number is underestimated. Whatever the number produced in a season, a very large percentage of them reach maturity, for soon after birth they swim very strongly, and are said to have been seen fiercely pursuing fish longer than themselves. Such an animal 6 inches long has comparatively few enemies, if we except his fellow sharks, and instances when "dog eats dog."

EXTERMINATION IMPRACTICABLE.

The word "exterminate" has been misused in ordinary discussions of the dogfish problem. Extermination is impracticable, even if not impossible. The only aim can be to limit the rate of increase by catching the greatest possible number of individuals, especially of the adults. Conditions must be developed which should make it for the immediate pecuniary advantage of the fishermen to market every dogfish, both large and small, which can be caught; thus the fishermen may be induced to work for the advantage of their successors. The present and future public which will benefit most should pay the expense, just as to-day the public pays the expense of damage caused by dogfish to fishing gear.

NATURE AND EXTENT OF DAMAGE BY DOGFISH, AS INDICATED BY SPECIAL REPORTS.

The following typical statements from masters of Massachusetts fishing vessels indicate in part the nature and the extent of the damage caused by the spiny dogfish during the season of 1905:—

September 5.—Schooner "Emilia Enos" of Provincetown, Capt. William Enos, arrived at Boston September 5 from South Channel, with a broken trip of 5,000 pounds of fresh haddock and 5,000 pounds of fresh codfish, the whole stock amounting to about \$250. The broken trip was the result of the ravages of the dogfish. The trawls lost amounted to 30 tubs, valued at \$150. If the dogfish were not numerous, an average catch would have been about 50,000 pounds of fish, and stock \$1,000. On this trip, lasting about a week, the loss to this vessel, as will be seen, was \$750, and is due directly to the dogfish. Captain Enos estimates that not less than 20,000 dogfish were on his hooks; they were so numerous as to carry off his trawls.

Schooner "William Morse," which arrived at Boston the same day, reports the loss of 8 or 10 tubs of trawls by dogfish.

September 6.—Schooner "Mary C. Santos" of Provincetown, which arrived at Boston to-day, lost 9 tubs of trawls, or about 4,500 hooks, by the ravages of the dogfish. She fished in South Channel, where the dogfish have been very troublesome the past two weeks. Six other arrivals at Boston to-day from the ground report the dogfish very troublesome.

The pollock arrivals to-day from Jeffreys Bank and from the north shore report dogfish quite numerous and bothersome.

There are about 25 vessels that come to this market from Nantucket Shoals with fresh codfish, which they catch on hand lines. These vessels are not troubled by the dogfish, for the reason that they all use cockles for bait, and they do not bite at that kind of bait.

September 7.—Schooner "Alena L. Young," Capt. Chas. Nelson, of Rockport, Mass., arrived at Boston August 26 from Jeffreys Bank pollock fishing, hand-line fishing. This vessel was out on the voyage ten days, and the crew of 10 men shared only 34 cents each, owing to the fact that dogfish were numerous on the fishing ground. Broken trips like this discourage the men, and often they leave the vessel.

Schooner "Evelyn L. Smith" of Boston, which arrived at Boston to-day from South Channel, reports the loss of about 500 hooks by dogfish. She brought in 7,500 pounds of fish, and would have had 40,000 pounds if the dogfish were not on the grounds. She fished in about 40 fathoms of water. Other arrivals at Boston to-day from South Channel came from the deeper part of South Channel, and report few or no dogfish.

The captain of the schooner "Harvester" of Provincetown states that in the spring of this year he was troubled by dogfish on the western part of Georges. On one voyage he lost 2,880 hooks.

September 8.—Capt. Herbert Nickerson of the schooner "Buema," which arrived at Boston to-day from South Channel, states that he was bothered more with dogfish this trip than any time this summer. He brought in 40,000 pounds of fresh haddock, 4,000 pounds of fresh codfish and 6,000 pounds of fresh hake. Reports losing 20 tubs of trawls, or about 10,600 hooks, besides the lines. He fished in 40 fathoms of water.

Schooner "Sea Fox" of Provincetown, Capt. B. S. Ramos, which arrived at Boston to-day from a fishing trip, reports the loss of 17

tubs of trawls, or about 5,800 hooks, by the ravages of the dogfish. He fished in South Channel, in about 40 fathoms water.

September 9. — Captain Keough of the schooner "Carrie F. Roberts," which arrived at Boston to-day from fishing on Middle Bank, states that on some sets half his catch was destroyed by dogfish, mostly by biting the fish. He estimates his loss on this trip as 2,000 pounds of fish. He reports dogfish numerous on Middle Bank. He fished on the outer edge of the Bank, in deep water, where there was the least dogfish. Very few vessels are now fishing in Boston Bay for groundfish, on account of the abundance of dogfish.

Sloop "Laura Enos" of Gloucester, Capt. E. J. Rose, which arrived at Boston to-day from Jeffreys Bank, had 5,000 pounds of fresh pollock from hand-line pollock fishing. She would have had twice this amount of fish had the dogfish not been so plenty. She lost about 430 hooks.

Schooner "Marshall L. Adams" of Provincetown, Capt. Antonio Silva, which arrived at Boston to-day, reports the loss of about 1,500 hooks by dogfish while fishing in South Channel on the trip from which he had just arrived.

September 11. — Schooner "Fish Hawk," Capt. James Paine of Provincetown, which arrived at this port to-day from fishing in South Channel, reports great annoyance by dogfish on the trip from which he just arrived. He fished about 75 miles southeast of Highland Light, in 33 fathoms of water. The dogfish struck, and he lost 15 tubs of trawls, valued at about \$5 per tub. They carried off 7,500 hooks, besides the trawl lines.

Schooner "Frances J. O'Hara," Captain Hickey of Boston, from South Channel, reports the loss of 9 tubs of trawls.

There have been arrivals at Boston the past few days from Jeffreys Bank, Georges Bank, Cashes Bank, Clarks Bank, Middle Bank, Nantucket Shoals, South Channel and shore grounds; none of them report any great loss on account of the dogfish. The arrivals from Jeffreys Bank, Middle Bank and the shore grounds, especially the eastern shore grounds, report more or less annoyance by the dogfish, and nearly all report small losses of hooks and gear.

A captain (Italian) of a gasoline boat, fishing out of Boston, informs me that he lost on one voyage about a month ago, while fishing in Boston Bay, about 2,000 hooks. This boat only carries 5 men and a total of 2,500 hooks, and fishes for codfish, haddock, hake, flounders, etc.

September 18. — Schooner "Marshall L. Adams" of Provincetown, Capt. A. C. Silva, arrived at Boston with a small catch of fish, due to the depredations of the dogfish. He had 6,000 pounds of fresh haddock, 20,000 pounds of fresh codfish and 1,000 pounds of fresh pollock. His loss in lines, hooks, etc., will amount to \$150 on this trip. He lost 30 tubs of trawls, or 12,000 hooks. He fished in South Channel, 40 miles southeast of Highland Light, Cape Cod, and states that he never saw dogfish so plenty.

Schooner "Harvester" of Provincetown, Capt. Daniel Venturo, which arrived at Boston to-day, reports the loss of 15 tubs of trawls, valued at

\$75, while on fishing trip to South Channel. Sharks were also quite numerous.

The hand-line arrivals from Jeffreys and along the shore continue to report great annoyance by the dogfish, and the loss of several boxes of hooks each trip.

The Boston schooner "Onato," Captain Larkin, which arrived at Boston September 14, reports losing 20 tubs of trawls, valued at \$100, on a fishing trip lasting one week in South Channel.

September 22.—Schooner "Nettie Franklin" of Provincetown, Captain Caton, arrived at Boston to-day from South Channel, with 24,000 pounds of groundfish. Captain Caton reports that the dogfish were very numerous, and on the last set of the trawls estimates that they caught as many as 20,000. He lost about 4 tubs of trawls, valued at \$5 a tub.

The schooner "Mary C. Santos" arrived at Boston September 21 from South Channel with 9,000 pounds of fresh haddock, 31,000 pounds of fresh codfish and 2,000 pounds of fresh pollock. The captain states that he was very much bothered by dogfish, and would have had twice the amount of fish if it had not been for them. He lost 5 tubs of trawls.

The vessels arriving at Boston the past few days from other fishing grounds than South Channel report little or no annoyance by dogfish.

Capt. Stilson Hipson, of schooner "Mystery" of Plymouth, Mass., which arrived at Boston from a fishing trip on Sept. 27, 1905, reports that dogfish were very numerous in South Channel. He set 24 trawls 70 miles southeast of Highland Light, Cape Cod, and only caught 3,000 pounds of marketable fish, getting a dogfish on every other hook. He should have caught 15,000 pounds of marketable fish on average fishing in that locality. He had to leave that locality on account of the dogfish.

Schooner "Marshall L. Adams" of Provincetown, Mass., Capt. A. C. Silva, which arrived at Boston September 28, reports dogfish still numerous on the in-shore fishing grounds off Cape Cod, but not very plenty off shore.

Schooner "Fish Hawk" of Boston arrived at Boston from a fishing trip on November 1. The captain reports setting 45 trawls in South Channel, in 45 to 50 fathoms of water. The dogfish were numerous, and he only got 100 pounds of food fish; whereas, if there had been no dogfish, on an average set he would have caught 7,000 pounds of food fish.

October 12.—The shore arrivals report dogfish very numerous along the shore and in Boston Bay, where it is almost impossible to set their fishing gear. The hand-line pollock fishermen, of which there are a large number, are experiencing a great deal of trouble with dogfish.

Arrivals from Georges Bank and South Channel also report finding dogfish more or less troublesome, but they are not so plentiful on these grounds as on the shore.

Captain Keough of the schooner "Carrie F. Roberts," which arrived at Boston from fishing in Boston Bay October 10, states that he caught

300 dogfish on 500 hooks set for groundfish the previous day. On a string of gear of about 4,500 hooks he got 1,800 dogfish.

Capt. Ed Doane of the schooner "Mertis H. Perry," which arrived at Boston October 9 from trawling in Boston Bay, reports much trouble from the dogfish, but no great loss of gear. He is of the opinion that if all the vessels in the fishing business should fit, and catch dogfish, they would not be able to reduce them in number, as they are so prolific and numerous.

Schooner "Louise Cabral," which arrived at Boston October 9, reports catching a dogfish with a rubber band around its head, just behind the pectoral fins, which had cut into the fish, and had evidently been on it some time. It was caught on a trawl, while fishing for groundfish off Chatham, October 8. It was a smooth dogfish, about a foot long.

Schooner "Emilia Enos" of Provincetown, Captain Enos, which arrived at Boston October 3, reports much annoyance by sharks while fishing in South Channel.

Capt. Alfred Green of the schooner "Flirt" of Gloucester, Mass., which arrived at Boston Oct. 19, 1905, from a fishing trip in South Channel, states that he lost \$50 worth of gear by sharks. He fished 70 miles southeast by south of Highland Light, in about 70 fathoms of water.

The schooner "Illinois" of Gloucester, Mass., Capt. John Lowrie, which arrived at Boston Oct. 17, 1905, reports losing \$100 worth of trawls by getting into a large school of dogfish. He fished in South Channel, in about 70 fathoms. He caught at least 10,000 dogfish on this voyage alone. He lost 20 tubs of trawls, which will have to be replaced by new gear.

October 16.—The captain of the schooner "Mary Edith" made five sets on the shore recently. In three sets he caught 16,000 pounds of marketable fish, but in the other two the dogfish struck, and he caught only 1,000 pounds of marketable fish.

Captain Benson of the schooner "Frances V. Sylvia," which arrived at Boston Oct. 20, 1905, reports losing 10 tubs of trawls by dogfish. He was out one week on the voyage, and fished in South Channel.

November 17.—Schooner "Marshall L. Adams" of Provincetown, Capt. A. C. Silva, which arrived at Boston Nov. 4, 1905, reports dogfish very numerous from Highland Light, Cape Cod, south along the shore. Small-sized dogfish are numerous close in shore; off shore they are large in size, but not so numerous. He lost 6 tubs of trawls on this voyage, worth about \$36, due mostly to the dogfish.

Capt. Julius Anderson of the Boston schooner "Robert & Arthur," which arrived at Boston Nov. 10, 1905, from a fishing trip, states that he found dogfish numerous in the northern as well as the southern part of Georges Bank. On the southern part of the Bank he set his trawls, and only got about 10 edible fish to a dory, as the dogfish were so numerous. He lost 10 tubs of trawls, valued at about \$60.

From the point of view of the shore fishermen, the following report is typical:—

BOSTON, July 31, 1905.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

SIR:— After making an observation in regard to the effect of dog-fish and other predatory fish upon food fish, I have the honor to submit to you the following report.

Two fishermen started from Gloucester on Friday morning, at 2 A.M., and arrived at Kettle Island trap, where they purchased 4 bushels of bait, for which they paid \$1.70. After baiting their trawls, which consisted of 3 tubs of 9 lines each, 50 hooks to a line, and $2\frac{1}{2}$ tubs of 10 lines to a tub, also having 50 hooks on each line, they proceeded to a place called Eagle's Ledge, which lies 5 miles southeast from Baker's Island and about 13 miles from Gloucester. These trawls, containing 2,600 hooks, and covering a distance of 3 miles, were set at 1 P.M., which required one hour, after which they started for Gloucester, arriving at 4 P.M.; time consumed, fourteen hours.

On Saturday morning a start was made at 2 A.M. from Gloucester to haul the trawls. They were found at 6 A.M., as it was very moderate, and fog was quite thick. The work was finished at 11 A.M., and after the boat arrived at Gloucester and discharged her fish it was 2 P.M.; time consumed, twelve hours.

The result was as follows:—

100 hooks, holding	100 baits.
131 hooks, holding	131 food fish.
13 hooks, holding	13 food fish, destroyed.
7 hooks, holding	7 monk fish.
65 hooks, holding	65 skates.
238 hooks, holding	238 small dogfish.
74 hooks, holding	74 large dogfish.
9 hooks, holding (lost hauling in)	9 large dogfish.
3 hooks, holding (lost hauling in)	3 food fish.
1,900 hooks, holding	nothing.

2,540 hooks (2,600 — 2,540 = 60, — 60 hooks lost).

Income:—

131 food fish, 780 pounds, at 80 cents per hundred (average price per fish, $4\frac{1}{3}$ cents),	\$6 24
74 large dogfish yielded $2\frac{1}{2}$ buckets of livers, at 25 cents per bucket,	63
	<hr/> \$6 87

Outgo:—

13 food fish destroyed, at $4\frac{1}{3}$ cents each,	\$0 62
60 hooks lost, valued at	14
60 gangings lost, valued at	14
85 hooks broken in removing dogfish, etc.,	18
85 gangings parted in removing dogfish, etc.,	18
2,350 baits consumed by dogfish,	1 56
	<hr/> 2 82

Net profits for 2 men, twenty-six hours' work, \$4 05

Small dogfish measured 15 to 19 inches, and weighed from $1\frac{1}{2}$ to $2\frac{1}{2}$ pounds each. Large dogfish measured 35 to 40 inches, and weighed

from 15 to 20 pounds each. These were all female fish, and were depositing young fish; the stomachs contained an occasional piece of bait and food fish. The small dogfish were hardly large enough to get the hook into their mouths.

Two days previous this same fishing gear was set in about the same location, and 2,000 pounds of food fish and 140 to 150 large dogfish and no small dogfish were caught. It is the opinion of the fishermen that the small dogfish eat the bait without getting caught to any extent.

Time consumed in the work, twenty-six hours; persons employed, 2. This is considered an average by the fishermen.

Yours respectfully,

EDWIN C. MCINTIRE.

On June 24 Mr. Paul M. Carpenter went to Provincetown to study the dogfish, with particular reference to the damage done directly and indirectly to marketable fish and to fishing gear. Mr. Carpenter went on several trips on fishing vessels which reported damage by dogfish. His personal observations, as embodied in his interim reports, follow:—

PROVINCETOWN, July 26, 1905

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—Schooner "Marshall L. Adams" of Provincetown, Antone Silva, master; trawler, 130 tons register; crew of 20 men; 75 miles southwest of Highland Light. Catch: cod, haddock and occasional halibut; several finback whales seen.

The dogfish, much to the surprise of the crew, were less plentiful than usual at this point and at this season of the year. The trawls brought up at each haul a large number of deep-sea scallops.

A sudden squall struck the vessel one day, with heavy wind and rain, sweeping overboard about 5,000 weight of fish, which had just been landed from the trawls. This catch included a number of dogfish, possibly 50. The squall struck the vessel so suddenly and so soon after the haul that there had been no time to examine the catch, and the entire haul was lost.

Of course a certain number of the dogfish hooked were lost in hauling in the different dories during the week of fishing. I had an opportunity, however, of examining about 250 dogfish. The larger proportion of these were not fully grown, and I noted that of the fish caught fully 4 out of 5 were females. Upon opening and dissecting the mature specimens, I found in every case, 4 fully developed embryos. In each case the egg-string contained a large number of eggs, in groups of 4, in various stages of development.

Upon examining the stomachs of the fish caught, I was surprised to find, with scarcely an exception, no material whatever except apparently what had been taken from the bait of the trawls. Upon examining the edible fish caught on the trawls, it was noticeable that very few presented the appearance of having been attacked by dogfish.

From these last two facts stated, together with the fact already stated, that the majority of the dogfish caught were not fully grown, it seems fair to conclude that the pugnacious nature in dogfish does not develop until they reach maturity. I found no trace of lobsters or of shellfish in the stomachs.

At Boston, on arrival of the schooner for a market, I transferred to the schooner "Annie Perry," Captain Perry, just about to sail for Provincetown, and returned to port on that vessel. On questioning the crew of the "Perry" I learned that their catch of dogfish on the trip just ended (and which had been to the same fishing ground as that visited by me) had been unusually small and comparatively insignificant.

It is the common opinion of the fishermen of Provincetown, as I have learned by extended inquiry, that the dogfish are far more troublesome in the month of August and the succeeding months than in any other time of the year. This would seem to indicate that the fish mature in August, both in size and in voracity.

I intend to take, if possible, about three more trips, and shall include the seiners and boat fishermen; and shall also investigate the condition of the dogfish problem in the harbor and vicinity.

Very respectfully,

PAUL MOULTON CARPENTER.

PROVINCETOWN, Aug. 9, 1905.

DR. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—While awaiting the return to the harbor of the mackerel seiners, on one of which I design to make a trip, I have employed my time in examining the harbor fisheries with reference to the dogfish problem. The report is unanimous that dogfish are far less numerous than usual thus far this season. Employees of the Consolidated Weirs Company, which concern operates several large weirs or traps within and just without the harbor, report that no dogfish are at the present time caught in these traps. A similar report comes from the owners of three weirs at the west end of the harbor. A boat came in to-night from a day's fishing at "the ledge," a favorite fishing ground for Provincetown fishermen, about 10 miles off Race Point and about midway between that point and Plymouth. They report good fishing for pollock, and only 3 dogfish caught during the day; these were "pups," about 1 foot in length.

The scarcity of dogfish in this vicinity is taken by the local fishermen in connection with a scarcity of mackerel which also prevails. It is the general prediction that the dogfish will return with the return of the mackerel schools in the bay. The mackerel is generally believed to be the favorite food of the dogfish; but it does not despise the cod, haddock or pollock when the mackerel is not at hand and easily obtained. It is common for trawlers to find on their trawls fragments of large fishes, and sometimes merely the heads of fishes, which have been caught on the trawls, and thus, unable to defend themselves, are attacked and eaten by the dogfish.

It is a persistent report among the fishermen of this port, and one which I hear constantly, that the dogfish have followed the mackerel

to the Maine and Nova Scotia coast. In support of this theory I annex a newspaper clipping, which originally appeared in the "New York Sun," concerning the dogfish on the coast of Maine. (See p. 166.)

I note the remarkable scarcity this summer of squid, which are used largely by fishermen for bait. While they at times swarm in great multitudes in this harbor, this summer the squid have been remarkably scarce. Porgies and herring are chiefly used for bait. Until recently porgies have also been scarce, but within the past few days there have been several large catches reported. The scarcity of bait has been a great injury to the Provincetown fisheries.

Two matters of possible interest to the commission, though not directly connected with the object of my appointment, are considered in special reports annexed herewith.

Very respectfully,

PAUL MOULTON CARPENTER.

PROVINCETOWN, Aug. 19, 1905.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—Schooner "Saladin," Capt. Florence M. McKown of Gloucester, seiner, left harbor of Provincetown August 13, at 4 A.M., accompanying a fleet of 60 sail of seiners. Watch was set when off Race Point, and was continued past Highland Light and out to sea, to a point about 70 miles southwest from the last-named point. The fleet remained in the channel about two days, and then coasted along the shore past Wellfleet and Truro, and thence to Minot's Ledge, and returned towards Cape Cod. The fleet was then obliged to seek harbor on account of storm, having been absent from port about five days. No mackerel were seen, and a number of vessels of the fleet which were spoken reported the same. The results of the trip, in the study of dogfish, were therefore disappointing.

Almost immediately upon my return to port a large school of dogfish were reported to have entered the harbor, and I am now engaged in inquiries as to their movements. I am also making some inquiries concerning some experiments, which I learn were made some years ago in this place, in the utilization of dogfish in the manufacture of oil and fertilizer. The results of these inquiries I will report later.

Very respectfully,

PAUL M. CARPENTER.

PROVINCETOWN, Sept. 9, 1905.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—On the morning of September 5 I went with one of the dory fishermen to the Ledge, a favorite fishing ground for Provincetown fishermen. We left Provincetown at about 4 o'clock A.M., reaching the grounds about 7.30. The wind was northeast; the tide was just about one-half; the depth of water at this point was about 20 fathoms. The fishing was on the bottom, the hooks just off the bottom. The catch amounted to about 4 hundredweight: about 1 hundredweight of cod, 2 hundredweight of pollock and 1 hundredweight of whiting. Not a single dogfish was hooked.

On the morning of September 7 we fished off Wood End, but still

no dogfish. We fished in about 30 fathoms of water, on a slack tide. The wind at this time was about northeast. The catch amounted to 5 hundredweight: 2 hundredweight of pollock, 1 hundredweight of cod (small), 1 hundredweight of hake and 1 hundredweight of whiting.

The squid have struck in here, having been for some time very scarce. The vessels are consequently starting for the middle banks and the channel. I have made arrangements to go on the schooner "Annie Perry" the first of the week.

The "Georgiana," hailing from this port, has just returned from the channel, reporting a catch of 90,000 pounds, including 25,000 pounds of large cod. She reports not a single dogfish taken on the trawls.

I will do my utmost to obtain data that will be of value to the commission on my trip to the channel.

Very respectfully,

PAUL M. CARPENTER.

PROVINCETOWN, Sept. 11, 1905.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—On Saturday, September 9, a party of 8 went to the Ledge for a day's fishing, and this time succeeded in finding a few dogfish. We started from Provincetown at 6 in the morning, and reached the fishing ground at 9 o'clock. We fished on the slack tide. The depth of water at this point was about 15 fathoms; the wind about north. The fishing was very good indeed for this season of the year. The catch amounted to about 12 hundredweight, mostly cod, pollock and hake, with a few haddock.

The dogfish, as the annexed list shows, although they stayed with us all the time, did not bite except at intervals. I examined the stomachs of the 48 caught, and found nothing except the bait taken from the hooks, and also long strings of tentacles which had been detached from medusæ.¹ The annexed list will show at what intervals the dogfish were caught.

Very respectfully,

PAUL MOULTON CARPENTER.

Schedule of Fishing at Ledge, off Race Point, Cape Cod, Saturday, Sept. 9, 1905.

Dogfish, cod, haddock, whiting.
Dogfish, cod, pollock.
Dogfish.
Dogfish.
Dogfish, hake, pollock, pollock, whiting.
Dogfish, hake, pollock, hake, cod, cod.
Dogfish, pollock, pollock, hake, cod.
Dogfish.
Dogfish, pollock, cod, hake, cod.
Dogfish, pollock, hake, cod, pollock.
Dogfish, cod, pollock, hake.
Dogfish, pollock, cod, cod, hake, pollock.
Dogfish, pollock, cod, pollock, hake.

Dogfish, pollock, cod, pollock, hake.
Dogfish.
Dogfish, cod, pollock, hake.
Dogfish, cod, pollock, pollock.
Dogfish, pollock, pollock, cod, hake.
Dogfish, cod, pollock, pollock, cod.
Dogfish.
Dogfish, cod, pollock, hake, pollock.
Dogfish, pollock, pollock, cod.
Dogfish, cod, pollock, pollock.
Dogfish, pollock, cod, hake, pollock, pollock.
Dogfish, cod, cod, pollock, hake.

¹ I have found dogfish stomachs full of ctenophores very much shrunken and shrivelled in appearance. — G. W. FIELD.

Schedule of Fishing, etc. — Concluded.

Dogfish, cod, pollock, hake, cod, cod.
 Dogfish, pollock, hake, pollock, cod, cod.
 Dogfish, pollock, pollock, cod, hake.
 Dogfish.
 Dogfish, cod, cod, pollock.
 Dogfish, pollock, cod, pollock, hake, cod.
 Dogfish, cod, pollock, hake.
 Dogfish, cod, cod, hake.
 Dogfish, hake, cod, cod.
 Dogfish, pollock, pollock, cod, hake.
 Dogfish, pollock, pollock, cod.
 Dogfish, cod, pollock, hake.

Dogfish, hake, cod, pollock, pollock.
 Dogfish, pollock, pollock, cod.
 Dogfish, cod, pollock, pollock, hake.
 Dogfish, cod, pollock, hake, cod.
 Dogfish, haddock, cod, pollock, hake.
 Dogfish, pollock, cod, haddock, pollock.
 Dogfish, cod, pollock, pollock, hake.
 Dogfish, pollock, cod, cod, pollock, hake.
 Dogfish, cod, hake, haddock.
 Dogfish, cod, pollock, hake, cod.
 Dogfish, pollock, cod.

PROVINCETOWN, Sept. 25, 1905.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR: — Schooner "Annie Perry," 117 tons register, left Provincetown for channel September 21, after a delay of more than ten days, caused by scarcity of bait. She is commanded by Capt. Marion Perry, and carries a crew of 20 men. The first set of trawls, which was made on the morning of the 22d, brought in nothing but dogfish for the first 4 dories, which set, as the captain said, in shoal water. The other 6 dories caught dogfish on their first 2 tubs of trawl, but on the remaining 3 dogfish were very few, biting at only every fifth or sixth hook. The wind was blowing brisk southwest, and the set was made in 45 fathoms of water.

The second set, on the afternoon of the same day, showed that the dogfish had practically left, as they were caught on the trawls at only the tenth or twelfth hook. The wind still held to the southwest, and the water at this point was 50 fathoms.

The second day of fishing developed the same facts as on the afternoon of the first day. The dogfish on this day, however, were very large, — larger, the captain said, than he had ever seen before. They averaged $3\frac{1}{2}$ and 4 feet in length, no small ones being caught. On the second day a large school of sharks, none of which were less than 10 feet in length, and one fully 15 feet in length, swarmed about the vessel. They were evidently after the bait, which was thrown overboard. They were not easily frightened. Two were caught and hauled on board and killed, and the carcasses thrown over again. The wind on the second day was about northwest, and the depth of water 55 fathoms.

At the end of the second day I had been able to examine 300 dogfish. In each case nothing was found in the stomachs save the bait taken from the trawls. In the majority of cases there were evidences of great voracity, the stomachs being crowded to their fullest capacity. It was noticeable that fully three-fourths of the dogfish caught were females. In no case did their bodies contain developed young.

The third day's fishing was in about 60 fathoms of water, and each dory brought in from 6 to 10 dogfish. I was able to examine 50 of these, and the result was the same as in the examinations on the previous days.

It might be well to explain that on the second day the dogfish came so fast that the men found it difficult to save their gear. On this account, only a small percentage of the fish were saved for my examination. The result of the trip shows beyond doubt that the dogfish run in schools, for the most part in shoal water. Among fishermen, from 40 to 50 fathoms is considered shoal. I have made inquiries here at Provincetown, and up to date this year hear no complaint of gear being lost by the depredations of dogfish.

Respectfully,

PAUL MOULTON CARPENTER.

PROVINCETOWN, Sept. 28, 1905.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—I deemed it best to defer, until near the close of my investigation concerning dogfish, any systematic inquiries concerning the damage done to gear by these fish; by so doing I should be able to procure more complete statistics. Upon my return from my recent trip to the channel, therefore, I began a systematic canvass of the captains and agents of the fishing vessels of this town, with the following results:—

Schooner "Fish Hawk," Capt. Joseph Paine, lost 20 tubs of trawl during her last two trips to the channel.

Schooner "Louisa Silva," Captain Silva, lost 15 tubs of trawl, during the same two trips.

Schooner "Louisa Cabral" lost 20 tubs during the last three trips.

Schooner "Sea Fox" lost 17 tubs in the middle of September.

Schooner "Julia Costa" lost 8 tubs during the last two trips.

Schooner "Philip Manta" lost 24 tubs during the last two trips.

The total damage experienced by these 6 vessels is, therefore, 104 tubs of trawl, worth \$8.50 each, making a total loss of \$884,—an average of \$147.33 each. There are still other vessels to be heard from, which are in the channel at the present time. The captains and agents of vessels all declare that when squid are used as bait there are plenty of dogfish on the trawls. On the other hand, when white bait is used, as porgie, herring, etc., fewer dogfish are found on the hooks.

There has been no mention of damage done by dogfish until within the last two trips.

It may be well to mention that the dogfish now caught are of different appearance from those seen earlier in the season. They are of a sandy color, and the ventral portion of white extends farther round. They are not as rough to the touch as formerly, but are quite smooth. All agree that the dogfish now running are very large, and that the men are obliged to work very hard to save their trawls from destruction.

Each vessel is allowed 60 tubs of trawl a year. When the dogfish are very plenty the allotted number is used, and sometimes the number is greatly exceeded.

I shall continue my canvass, and report further on this subject.

Very respectfully,

PAUL MOULTON CARPENTER.

I am able to add two names to the list of vessels whose gear has been lost or damaged through the depredations of dogfish:—

Schooner "Marshall L. Adams," Capt. Antone Silva, reports 8 tubs of trawl lost on last two trips.

Schooner "Mary C. Santos," Captain Santos, reports 15 tubs of trawl lost during the same two trips.

Both captains think that they fished too far to the southward. Other vessels are expected in a day or two.

The following is a statement by Deputy Foster, on the launch "Egret," covering the month of July:—

I have seen almost every trap hauled between Nahant and Rockport, and saw but one large lot of dogfish, and that was the trap at Dana's Island. There were in this haul about 75 barrels, which were taken off shore and thrown away. I saw one boat off Half-way Rock. I watched the hauling of the trawls for one-half hour, and, as near as it was possible for me to tell, he caught 250 dogfish and not much of anything else, for there were a dozen small codfish and haddock, mostly eaten up. The shore fishermen complain that they are having lots of trouble with them. There are some in every trap I saw hauled, but in most of them not enough to be very troublesome. In the Kettle Island trap they had 5 barrels of "bluebacks," 42 small dogfish and not much of anything else.

Our special agents interviewed 584 fishermen, from Newburyport to Newport, including masters of vessels, shore, net, trawls and hand line, and trap and weir fishermen. These agents asked questions designed to secure free, full and accurate replies to the questions below. This information has been tabulated. The questions and the results of the tabulated returns are as follows:—

Apparatus used (specify kind of apparatus used, and number of each kind). Hand lines, 6,833; nets, 8,224; gills, 1,536; tubs, 8,915; trawls, 1,742; weirs, 45.

How many pounds do you consider your average total annual catch of edible and bait fish? 194,915,050.

What do you consider a fair estimate of your annual catch of dogfish? 27,668,150.

Is this number a guess, or is it estimated on actual counts for a week or a month? Fair estimate.

During what months is the smooth dogfish present? April to December; most numerous in May and June and October to December. Practically limited to waters south of Cape Cod.

During what months is the spiny dogfish present? April to December in all waters off shore, to 50 to 75 fathoms.

Do dogfish damage your apparatus? Yes, 586; no, 3.

What do you consider a fair estimate of the annual damage done by dogfish to your seines, nets, trawls, bait, hand lines, weirs, traps?

Seines, \$6,550; nets, \$27,181; trawls, \$58,998.50; bait, \$56,158; hand lines, \$10,830; weirs, \$1,000; traps, \$100; total, \$160,817.50.

Is the above figure a guess, or is it based upon actual records of expenses caused by dogfish, of loss of material and of time spent in repairs? Fair estimate, 475; guess, 89.

Are many fish caught by your apparatus eaten or bitten by dogfish so as to destroy market value? Yes, 533; no, 41.

What do you consider a fair estimate of the value of the fish caught in your apparatus and made worthless by dogfish? \$250,405.

Do you kill the dogfish captured? Yes, 511; no, 40.

In your opinion, does the dogfish do appreciable damage to the supply of edible and bait fish? Yes, 578; no, 3.

Has there been an average total catch of fish this season? Yes, 233; no, 353.

Do you note any increase or decrease in the numbers of dogfish in the past year? Increase, 346; about same, 159; decrease, 86.

In your opinion, has there been an increase or decrease in the past ten years? Increase, 544; decrease, 22; about the same, 2.

Do you make any use of dogfish? Yes, 44; no, 506.

If so, what? Livers.

What value do you place on the dogfish so used? \$444.

What, in your opinion, would be the effect of a bounty on dogfish? Good, 582; bad, 7.

Would it decrease the number of dogfish? Yes, 523; no, 3.

Would it increase the profits of the fishermen? If so, how? Yes, 569; no, 12.

Would it increase the supply of food fish, and thus benefit the public? Yes, 587; no, 1.

Would a decrease in the number of dogfish lessen the expense of catching food fish? Yes, 584; no, 3.

The following is a copy of the circular used to secure the information from which the preceding returns were tabulated:—

COMMONWEALTH OF MASSACHUSETTS,
COMMISSION ON FISHERIES AND GAME, STATE HOUSE, BOSTON.

Acting according to chapter 12 of the Resolves of 1905, the Massachusetts Commission on Fisheries and Game requests from you a statement containing information which may be used in support of a bill pending in Congress "to provide for the extermination of the dogfish and other predatory fish." The evidence of the damage caused by these fish must be put in proper form. It is of the greatest importance that you make your answers as accurate as possible, so that the information may be of some value. You are therefore requested to give the following questions the fullest and fairest answers possible.

Apparatus used (specify kind of apparatus used, and number of each kind).

How many pounds do you consider your average total annual catch of edible and bait fish?

What do you consider a fair estimate of your annual catch of dogfish?

Is this number a guess, or is it estimated on actual counts for a week or a month?

During what months is the smooth dogfish present?

During what months is the spiny dogfish present?

Do dogfish damage your apparatus?

What do you consider a fair estimate of the annual damage done by dogfish to your nets, trawls, bait, hand lines?

Is the above figure a guess, or is it based upon actual records of expenses caused by dogfish, of loss of material and of time spent in repairs?

Are many fish caught by your apparatus eaten or bitten by dogfish so as to destroy market value?

What do you consider a fair estimate of the value of the fish caught in your apparatus and made worthless by dogfish?

Do you kill the dogfish captured?

If so, how? (Clubbing, stabbing, cutting off tail, etc.)

In your opinion, does the dogfish do appreciable damage to the supply of edible and bait fish?

Has there been an average total catch of fish this season?

For how many years have you fished in Massachusetts waters? Where?

Do you note any increase or decrease in the numbers of dogfish in the past year?

In your opinion, has there been an increase or decrease in the past ten years?

What, in your opinion, is the cause?

Do you make any use of dogfish? If so, what?

What value do you place on the dogfish so used?

What, in your opinion, would be the effect of a bounty on dogfish?

Would it decrease the number of dogfish?

Would it increase the profits of the fishermen? If so, how?

Would it increase the supply of food fish, and thus benefit the public?

Would a decrease in the number of dogfish lessen the expense of catching food fish?

Remarks: —

Name

Name of vessel

Town

County

Date

Replies to the above circular have been received from the following persons:—

NAME.	Town.	Name of Vessel.
Abrahamson, A. S., . . .	Gloucester, . . .	Scud.
Acker, Joshua, . . .	Swampscott, . . .	(Dory.)
Adams, Charles C., . . .	Newburyport, . . .	(Gasoline boat.)
Ahlquist, Erik, . . .	Rockport, . . .	Jessie P.
Allen, William, . . .	Marblehead, . . .	(Gasoline boat.)
Amiro, Adolphus, . . .	Beverly, . . .	James R. Clark.
Anderson, G. B., . . .	Gloucester, . . .	Rob Roy.
Anderson, Julius, . . .	Boston, . . .	Robert and Arthur.
Andrews, Elmer, . . .	Ipswich, . . .	(Gasoline boat.)
Andrews, Fuller A., . . .	Manchester, . . .	(Sail boat and a weir.)
Atkinson, W. B., & Co., . . .	Ipswich, . . .	(Gasoline boat.)
Atwood & Corrigan, . . .	East Brewster, . . .	(Three dories.)
Atwood, John, . . .	Gloucester, . . .	Yakima.
Aubin, Bennett, . . .	Newburyport, . . .	(Dory.)
Avela, Joseph, 2d, . . .	Provincetown, . . .	(Sail dory.)
Avina, Manuel, . . .	Gloucester, . . .	Eva Avina.
Bailey, Samuel S., . . .	Ipswich (Grape Island), . . .	(Gasoline boat.)
Bailey, William, . . .	Rockport, . . .	Alena L. Young.
Bangs, John B., . . .	Provincetown, . . .	John W. Caswell.
Barrett, Jacob P., . . .	Gloucester, . . .	Marguerite.
Barrett, John F., . . .	Gloucester, . . .	Lillian.
Bartles, Henry, . . .	Rockport, . . .	Evelyn M.
Barton, John, . . .	Rockport, . . .	Mercedes.
Bassett, Daniel S., . . .	South Chatham, . . .	(Sail boat.)
Bassett, Frank, . . .	Barnstable, . . .	Two Friends.
Bayley, Charles A., . . .	Ipswich (Grape Island), . . .	(Gasoline boat.)
Bearse, George N., . . .	South Chatham, . . .	(Sail boat.)
Bearse, Washington, . . .	Chatham, . . .	(Sail boat.)
Benham, Robert B., . . .	Gloucester, . . .	Lizzie W. Hunt.
Bennett, John, . . .	Manchester, . . .	(Dory.)
Benson, Benjamin T., . . .	Provincetown, . . .	Frances V. Sylvia.

NAME.	Town.	Name of Vessel.
Bergsten, Peter, . . .	Gloucester, . . .	Wodan.
Bigalke, Agust, . . .	Rockport, . . .	Etta B.
Bignall, J. H., . . .	Plymouth, . . .	Katie L.
Black, Stephen, . . .	Gloucester, . . .	Indiana.
Blackman, David B., . .	Brant Rock, . . .	Gracie.
Blades, Leslie, . . .	Boston, . . .	John M. Keen.
Blanchard, Fred, . . .	Swampscott, . . .	(Dory.)
Boozeli, Tony, . . .	Boston, . . .	Two Brothers.
Boudort, Alfred, . . .	Gloucester, . . .	Georgianna.
Boudreault, Lawrence, .	Boston, . . .	Genesta.
Boudreault, Thomas A., .	Provincetown, . .	Esther Gray.
Bowden, Benjamin, . . .	Lanesville, . . .	Venus.
Boyden, Walter, . . .	Swampscott, . . .	(Dory.)
Brackett, Theophilus, .	Swampscott, . . .	(Dory.)
Braja, Joseph, . . .	Rockport, . . .	Vamos.
Brazier, Eben A., . . .	Gloucester, . . .	Petrel.
Brewer, Roland, . . .	Boston, . . .	M. Madeline.
Briggs, Charles, . . .	Marblehead, . . .	(Dory.)
Brigham, J. O., . . .	Boston, . . .	Shepherd King.
Brinnick, William P., .	Boston, . . .	Jennie Maud.
Brooks, John S., . . .	Gloucester, . . .	Ida.
Brown, Alonzo L., . . .	Ipswich, . . .	(Gasoline boat.)
Brown, George A., . . .	Provincetown, . .	A. Brown.
Burch, A. L., . . .	Provincetown, . .	Jennie A. Hooper.
Burgess, Warren, . . .	East Brewster, . .	- -
Burnham, Leroy, . . .	Essex, . . .	(Gasoline boat.)
Burnham, Sherman, . . .	Essex, . . .	(Gasoline boat.)
Burns, John, . . .	Boston, . . .	Mary F. Fallon.
Bushee, Alexander D., .	New Bedford, . .	Leone.
Butler, George, . . .	Swampscott, . . .	(Dory.)
Cahoon, Alonzo F., . . .	South Chatham, . .	T. J. Carroll.
Cahoon, Otis, . . .	Swampscott, . . .	(Dory.)
Cain, Frank, . . .	Gloucester, . . .	Day Dream.
Callahan, Leonard, . . .	Essex, . . .	(Gasoline boat.)

NAME.	Town.	Name of Vessel.
Callahan, Michael, . . .	Essex, . . .	(Gasoline boat.)
Cameron, Reuben, . . .	Gloucester, . . .	Grayling.
Campbell, Charles J., . . .	Provincetown, . . .	Active.
Carlos, E. M., . . .	Gloucester, . . .	Pythian.
Carroll, Frank, . . .	Gloucester, . . .	M. H. Perkins.
Carter, Edward H., . . .	Gloucester, . . .	Sarah.
Caswell, Charles A., . . .	Newburyport, . . .	(Dory.)
Caton, John B., . . .	Provincetown, . . .	Albert Brown.
Chapman, Hiram, . . .	Gloucester, . . .	Ramona.
Chapman, John C., . . .	Beverly, . . .	Trump.
Chard, Frank, . . .	Gloucester, . . .	Bessie A.
Chase, John, . . .	Newburyport, . . .	(Sail boat.)
Chitwynd, William C., . . .	Gloucester, . . .	Volant.
Christianson, Martin, . . .	Gloucester, . . .	Patriot.
Churchill, Henry A., . . .	Ipswich, . . .	(Gasoline boat and dory.)
Cilley, C. B., . . .	Newburyport, . . .	(Dory.)
Cilley, James, . . .	Newburyport, . . .	(Dory.)
Claxton, John F., . . .	Ipswich, . . .	(Gasoline boat.)
Clay, Manuel, . . .	Provincetown, . . .	(Power dory.)
Cobb, John K., . . .	Provincetown, . . .	Betsey Ross.
Coffin, Frank, . . .	Newburyport, . . .	(Dory.)
Colberg, Ed., . . .	Newport, R. I., . . .	Winnie Kane.
Colson, Samuel, . . .	Gloucester, . . .	Margaret.
Connolly, John, . . .	Rockport, . . .	Leo.
Contrino, Gaspi C., . . .	Rockport, . . .	(Gasoline dory.)
Cook, Jerry E., . . .	Gloucester, . . .	Carrie Babson.
Cooney, James S., . . .	Rockport, . . .	Annie and Jamie.
Coop, John F., . . .	Provincetown, . . .	Florence.
Corca, William J., . . .	Provincetown, . . .	Lear C.
Corkum, William, . . .	Gloucester, . . .	Diana.
Costa, Emanuel, . . .	Provincetown, . . .	Jessie Costa.
Costa, John, . . .	Provincetown, . . .	(Power dory.)
Costa, John, . . .	Provincetown, . . .	(Power dory.)
Costa, J. E., . . .	Boston, . . .	Mildred Robinson.

NAME.	Town.	Name of Vessel.
Courant, Antone, . . .	Gloucester, . . .	Smuggler.
Crane, Herman, . . .	Ipswich, . . .	(Gasoline boat.)
Crittenden, Samuel, . . .	Gloucester, . . .	Mattie Winship.
Crocker, Dean F., . . .	Gloucester, . . .	Wm. H. Clements.
Crooks, James, . . .	Newburyport, . . .	(Dory.)
Crouse, Oberlin, . . .	Gloucester, . . .	Agnes Downes.
Crowell Cold Storage Company,	East Dennis, . . .	- -
Crowell, I. K., . . .	Boston, . . .	Zephyr.
Crowell, Leonard, . . .	Gloucester, . . .	Claudia.
Crowell, Thomas, . . .	Gloucester, . . .	Carrie C.
Crowley, Emanuel, . . .	Provincetown, . . .	Lucy E.
Cunningham, E. J., . . .	Boston, . . .	Stranger.
Currier, Charles S., . . .	Newburyport, . . .	(Dory.)
Curtis, Edward, . . .	Marblehead, . . .	(Dory.)
Curtis, Henry W., . . .	Gloucester, . . .	Mary F. Curtis.
Cushing, William M., . . .	Green Harbor, . . .	- -
Cushman, Cassius E., . . .	Rockport, . . .	Mary J. Ward.
Daggett, Allton, . . .	Provincetown, . . .	Pearl.
Daley, Jason M., . . .	Boston, . . .	Muriel.
Daly, H., . . .	Boston, . . .	Harmony.
Davis, Charles, . . .	Beverly, . . .	Viking.
Davis, Joseph F., . . .	Provincetown, . . .	Bessie.
Davis, Manuel, . . .	Provincetown, . . .	M. Enos.
Dent, John T., . . .	Marblehead, . . .	Yankee.
Devine, Archie, . . .	Gloucester, . . .	Arthur James.
Devine, Norman, . . .	Gloucester, . . .	James A. Garfield.
Devine, William A., . . .	Boston, . . .	Rapidan.
Doane, Ed. E., . . .	Swampscott, . . .	Mertis H. Perry.
Doane, Lorenzo F., . . .	Harwichport, . . .	Athlete.
Dolan, John E., . . .	Ipswich, . . .	(Gasoline boat.)
Doleman, Allen, . . .	Gloucester, . . .	Appomattox.
Domingoes, Manuel, . . .	Gloucester, . . .	Belbina P. Domingoes.
Doucette, Charles E., . . .	Gloucester, . . .	Acacia.
Douglass, Fred G., . . .	Gloucester, . . .	Gladys Lee.

NAME.	Town.	Name of Vessel.
Douglass, George W., . . .	Gloucester, . . .	Mary Elizabeth.
Douglass, Joseph G., . . .	Gloucester, . . .	(Trap.)
Douglass, Rodney, . . .	Swampscott, . . .	(Dory.)
Douglass, Simon, . . .	Swampscott, . . .	(Dory.)
Douglass, Thomas, . . .	Gloucester, . . .	(Trap.)
Downie, Thomas, . . .	Gloucester, . . .	Monarch.
Dresser, William W., . . .	Rockport, . . .	Mildred.
Dunsky, Peter P., . . .	Gloucester, . . .	Hattie L. Trask.
Dwyer, James, . . .	Gloucester, . . .	Annie Greenlaw.
Eaton, Jabez M., . . .	Newburyport, . . .	(Dory.)
Eaton, James, . . .	Newburyport, . . .	(Dory.)
Eaton, Lurin F., . . .	Newburyport, . . .	(Dory.)
Eaton, Nelson, . . .	Newburyport, . . .	(Dory.)
Eaton, William, . . .	Newburyport, . . .	(Dory.)
Edwards, Antone, . . .	Provincetown, . . .	(Power dory.)
Eldredge, James, & Son,	Brewster, . . .	- -
Eldridge, Seth W., . . .	Harwichport, . . .	Beatrice Earle.
Ellis, Gilbert E., . . .	East Brewster, . . .	(Dories.)
Elwell, Sylvanus, . . .	Gloucester, . . .	Pluto.
Engstrom, Ernest T., . . .	Gloucester, . . .	Thalia.
Enos, Antone, . . .	Gloucester, . . .	Catherine D. Enos.
Enos, Emanuel, . . .	Gloucester, . . .	Marina.
Enos, Manuel, . . .	Gloucester, . . .	Marian.
Enos, Manuel, . . .	Provincetown, . . .	(Power dory.)
Enos, William, . . .	Gloucester, . . .	Rita Viator.
Fellows, Charles, . . .	Salem, . . .	- -
Fewers, Edward, . . .	Gloucester, . . .	Azorian.
Firth, Lemuel, . . .	Gloucester, . . .	Cherokee.
Fisher, William J., . . .	Beverly, . . .	Grace Darling.
Foley, Charles, . . .	Newburyport, . . .	(Dory.)
Foley, William, . . .	Gloucester, . . .	J. W. Bradley.
Forbes, Edward C., . . .	Boston, . . .	Flavilla.
Forbes, Warren, . . .	Gloucester, . . .	Alice R. Lawson.
Fortado, M. P., . . .	Gloucester, . . .	Rebecca Bartlett.

NAME.	Town.	Name of Vessel.
Fowler, Emery M., . . .	Salisbury, . . .	(Dory.)
Fowler, Israel E., . . .	Salisbury, . . .	(Dory.)
Fowler, James, . . .	Duxbury, . . .	Massasoit.
Fowler, John L., . . .	Newburyport, . . .	(Dory.)
Fowler, Richard, . . .	Salisbury, . . .	(Dory.)
Fowler, William L., . . .	Salisbury, . . .	(Dory.)
Francis, James, . . .	Gloucester, . . .	Sachem.
Francis, Joseph, . . .	Provincetown, . . .	Kate Maxwell.
Francis, Joseph, . . .	Provincetown, . . .	Glennelg.
Francis, M. J., . . .	Provincetown, . . .	(Power dory.)
Francis, William, . . .	Provincetown, . . .	Minnie.
Frazier, James S., . . .	Boston, . . .	Mattie D. Brundage.
Freeman, John E., . . .	Provincetown, . . .	Milton.
Frost, Lorin, . . .	Gloucester, . . .	Pearl.
Frye, Abner, . . .	Beverly, . . .	Edna.
Frye, A. P., & Co., . . .	Salisbury, . . .	(Dory.)
Gannon, James, . . .	Boston, . . .	Shenandoah.
Gauss, Charles, . . .	Beverly, . . .	(Dory.)
Gedrey, Benjamin J., . . .	Gloucester, . . .	Mary A.
Gifford, Robinson, . . .	Gloucester, . . .	Conqueror.
Gillant, Gilbert, . . .	Gloucester, . . .	F. W. Homans.
Gillis, David, . . .	Gloucester, . . .	Maxwell.
Gitz, John, . . .	Manchester, . . .	(Dory.)
Gogetcher, Alex., . . .	Gloucester, . . .	Almeida.
Gonvreau, Andrew, . . .	Gloucester, . . .	William H. Moody.
Goodwin, Benjamin, . . .	Gloucester, . . .	Braganza.
Goodwin, Gilbert, . . .	Gloucester, . . .	Gossip.
Goodwin, James, . . .	Gloucester, . . .	Agnes.
Goodwin, James A., . . .	Gloucester, . . .	Edward A. Rich.
Goodwin, James D., . . .	Gloucester, . . .	Ella G. Goodwin.
Goodwin, Jeremiah, . . .	Boston, . . .	Thos. Brundage.
Goodwin, Joseph A., . . .	Manchester, . . .	Gardner Heath.
Gott, Chester W., . . .	Rockport, . . .	Catherine.
Goulart, Antonio P., . . .	Boston, . . .	Walter P. Goulart.

NAME.	Town.	Name of Vessel.
Gould, Roscoe H., . . .	West Chatham, . . .	(Sail boat.)
Gould, Stephen W., . . .	South Chatham, . . .	Asprel.
Gove, Robert F., . . .	Ipswich, . . .	(Gasoline boat.)
Grady, Daniel, . . .	Gloucester, . . .	Speculator.
Graham, Joseph E., . . .	Boston, . . .	Evelyn Smith.
Grant, Peter, . . .	Gloucester, . . .	Gracie.
Gray, John, . . .	Gloucester, . . .	Minnie.
Green, Alfred, . . .	Gloucester, . . .	Flirt.
Greenlow, Albert, . . .	Gloucester, . . .	Emerald.
Greer, Matthew, . . .	Boston, . . .	H. G. Martin.
Griffen, Albert J., . . .	Lanesville, . . .	Alice.
Gross, George L., . . .	Gloucester, . . .	Priscilla.
Gross, Melvin J., . . .	Gloucester, . . .	Defender.
Groves, Edward, . . .	Gloucester, . . .	A. T. Gifford.
Guthrie, Martin, . . .	Boston, . . .	Alice W. Guthrie.
Hains, Alex, . . .	Gloucester, . . .	Meteor.
Hall, Augustus, . . .	Gloucester, . . .	Faustina.
Hall, Emery A., . . .	Ipswich, . . .	(Gasoline boat.)
Hall, Frank, . . .	Gloucester, . . .	Ralph L. Hall.
Hamilton, John, . . .	Duxbury, . . .	Massachusetts.
Hamor, George, . . .	Gloucester, . . .	Corsair.
Hanson, Benjamin, . . .	Gloucester, . . .	On Time.
Hanson, Edward, . . .	Gloucester, . . .	Reliance.
Hanson, Sven, . . .	Gloucester, . . .	Sylvester.
Harding, James T., . . .	Boston, . . .	Viking.
Harding, Thomas, . . .	Gloucester, . . .	Two Forty.
Harriden, George, . . .	Lanesville, . . .	(Sail dory.)
Harris, John T., . . .	Ipswich, . . .	(Gasoline boat.)
Harty, Charles, . . .	Gloucester, . . .	Mary E. Harty.
Harvey, Isaac, . . .	Essex, . . .	(Gasoline boat.)
Hatch, Joseph, . . .	Duxbury, . . .	Mooween.
Hathaway, James, . . .	Beverly, . . .	(Gasoline boat.)
Haynes, John E., . . .	Ipswich, . . .	(Gasoline boat.)
Heath, Edward, . . .	Manchester, . . .	(Sail boat.)

NAME.	Town.	Name of Vessel.
Hemeon, James W., . . .	Gloucester, . . .	Mattacommet.
Henderson, Thomas P., . . .	Provincetown, . . .	Jessie.
Hickey, John,	Boston,	F. J. O'Hara, Jr.
Hickman, Benjamin, . . .	Salem,	- -
Hickman, George E., . . .	Gloucester,	Slade Gorton.
Higgins, James F.,	Brewster,	- -
Hilton, A. P.,	Newburyport,	(Gasoline boat.)
Hipson, Stetson,	Plymouth,	Mystery.
Hisks, H. L.,	Boston,	Bertha M. Bailey.
Hobert, Joseph,	Provincetown,	Vesta.
Hodgdon, Parkman,	Gloucester,	Robert C. Harris.
Hodsdon, Benjamin,	Gloucester,	Dixie.
Hodsdon, Lovell,	Gloucester,	(Gasoline dory.)
Hogizell, Albert,	Beverly,	(Dory.)
Holland, Edgar I.,	Ipswich,	(Gasoline boat.)
Holmes & Doten,	Plymouth,	Albertine.
Horton, Jeremiah,	Swampscott,	(Dory.)
Howard, Fred,	Beverly,	Boyd and Leeds.
Howes, Collins E.,	Chatham,	(Sail boat.)
Hoyt, Charles,	Newburyport,	(Gasoline boat.)
Hudder, Albert,	Gloucester,	A. M. Nicholson.
Hull, Fred R.,	Ipswich,	(Dory.)
Hull, Justin E.,	Ipswich,	(Gasoline boat.)
Hunt, F. E. & A. E., . . .	Salisbury,	(Gasoline boat.)
Hunter, Alexander,	Chatham,	- -
Inglestead, W. N.,	Green Harbor,	- -
Jacobs, Solomon,	Gloucester,	Veda M. McKown.
Jamison, Ed.,	Boston,	Mattie D. Brundage.
Jedrey, Frank,	Rockport,	Eddie Minot.
Jerault, E. C.,	Barnstable,	Charlie.
Jewell, Ned M.,	Ipswich,	(Gasoline boat.)
Jewett, James A.,	Gloucester,	Grace E. Freeman.
Jewett, Silas,	Gloucester,	Arrow.
Johnson, Alfred,	Gloucester,	Lelia E. Norwood.

NAME.	Town.	Name of Vessel.
Johnson, Benjamin, . . .	Gloucester, . . .	Lawrence Murdock.
Johnson, Edward, . . .	Newburyport, . . .	(Gasoline boat.)
Johnson, John, . . .	Provincetown, . . .	Barbara.
Johnson, J. R., . . .	Gloucester, . . .	James S. Steele.
Johnson, Nicholas, . . .	Gloucester, . . .	Cecil H. Low.
Johnson, Peter J., . . .	Rockport, . . .	City of Everett.
Jones, D. C., . . .	Manchester, . . .	(Gasoline boat.)
Joseph, Frank, . . .	Provincetown, . . .	(Power dory.)
Joseph, S. A., . . .	Provincetown, . . .	Angelenca.
Joseph, W., . . .	Provincetown, . . .	(Power dory.)
Joyce, Rowell, . . .	Gloucester, . . .	Beulah Maud.
Keefe, John W., . . .	Gloucester, . . .	Diana.
Kehoe, Wallace, . . .	Swampscott, . . .	(Dory.)
Kelly, Patrick H., . . .	Beverly, . . .	(Dory.)
Kelley, Reuben O., . . .	Provincetown, . . .	Georgie.
Kendrick, Albert F., . . .	Chathamport, . . .	Lillian.
Kendrick, William, . . .	Boston, . . .	George E. Lane, Jr.
Kenney, Wallace, . . .	Beverly, . . .	Governor Cleaves.
Kent, Edward, . . .	Ipswich, . . .	(Dory.)
Kilburn, John, . . .	Ipswich, . . .	(Gasoline boat.)
Kimball, Charles H., . . .	Beverly, . . .	Dorothy.
King, Joe, . . .	Provincetown, . . .	(Power dory.)
King, Walter, . . .	Newburyport, . . .	(Gasoline boat.)
Kingsley, Herbert, & Co., . . .	Salisbury, . . .	(Dory.)
Kirk, John, . . .	Marblehead, . . .	(Gasoline boat.)
Krups, P., . . .	Marblehead, . . .	(Dory.)
Lane, George & John, . . .	Essex, . . .	(Gasoline boat.)
Lane, Oscar, . . .	Beverly, . . .	Helen B. Lane.
Larkin, James H., . . .	Boston, . . .	Onato.
Larkin, Murray, . . .	Gloucester, . . .	William H. Cross.
Larkin, William, . . .	Beverly, . . .	Jamboree.
Larkin, William B., . . .	Gloucester, . . .	Sceptre.
Latimer, Gardner C., . . .	Newburyport, . . .	(Dory.)
Lawson, Nels, . . .	Gloucester, . . .	Ella G. King.

NAME.	Town.	Name of Vessel.
Leonard, Matthew, . . .	Boston, . . .	T. H. Cronwell.
Lewis, Alex., . . .	New Bedford, . . .	Laura E.
Lewis, Leonard, . . .	Swampscott, . . .	(Dory.)
Lewis, William B., . . .	Provincetown, . . .	Reliance.
Livingston, Alex., . . .	Provincetown, . . .	(Dory.)
Lord, J. A., . . .	Ipswich, . . .	(Gasoline boat.)
Lorentzen, Frank, . . .	Gloucester, . . .	E. A. Hooper.
Lovell, Herbert, . . .	Yarmouth, . . .	— —
Lowrie, John S., . . .	Gloucester, . . .	Illinois.
Lubee, Morris, . . .	Boston, . . .	Geo. H. Lubee.
Lufkin, Henry C., . . .	Gloucester, . . .	Esther Madelene.
Lunt, Clarence C., . . .	Newburyport, . . .	(Gasoline boat.)
Luth, Christian, . . .	Newport, R. I., . . .	On Time.
Luth, W. C., . . .	Newport, R. I., . . .	Olga.
Lyle, John, . . .	Provincetown, . . .	Gracie.
Lyle, Joseph A., . . .	Gloucester, . . .	Nourmahal.
Lyons, W. H., . . .	Gloucester, . . .	Wm. H. Ryder.
Mailman, William, . . .	Gloucester, . . .	Albert Geigher.
Malkis, Joe, . . .	Provincetown, . . .	(Power dory.)
Malone, Charles C., . . .	Gloucester, . . .	Orinoco.
Marchant, Horace M., . . .	Lanesville, . . .	(Sail dory.)
Marsh, Robert, . . .	Swampscott, . . .	(Dory.)
Martin, Benjamin, . . .	Swampscott, . . .	(Dory.)
Martin, Charles, . . .	Gloucester, . . .	N. A. Rowe.
Martin, John, . . .	Gloucester, . . .	Helena.
Mayo, Alfred A., . . .	Provincetown, . . .	Iris.
Mayo, Herman L., . . .	Provincetown, . . .	Little Jennie.
McComiskey, Asa, . . .	Boston, . . .	Alcina.
McComiskey, T. W., . . .	Boston, . . .	Catherine D. Burke.
McDonald, Daniel J., . . .	Duxbury, . . .	Squanto.
McDonald, James, . . .	Gloucester, . . .	Edwin B. Holmes.
McDonald, John, . . .	Boston, . . .	Grace W. Hone.
McEachen, Alex., . . .	Gloucester, . . .	Maggie and May.
McFarland, John, . . .	Gloucester, . . .	Mary E. Webb.

NAME.	Town.	Name of Vessel.
McGrath, Laurence, . . .	Gloucester, . . .	Hobo.
McGray, Benjamin F., . . .	Gloucester, . . .	Norma.
McHenry, James, . . .	Gloucester, . . .	Theodore Roosevelt.
McInnis, John, . . .	Gloucester, . . .	Aloha.
McKay, James, . . .	Gloucester, . . .	- -
McKenney, Herbert T., . . .	Ipswich, . . .	(Gasoline boat.)
McKinnon, John A., . . .	Gloucester, . . .	Norumbega.
McLain, George E., . . .	Rockport, . . .	Atlantic.
McLean, Albert, . . .	Marblehead, . . .	(Gasoline boat.)
McLoud, Alex., . . .	Gloucester, . . .	Leander F. Gould.
McLoud, Simeon, . . .	Gloucester, . . .	Northern Eagle.
McNeil, Roderick, . . .	Gloucester, . . .	Senator Salisbury.
McPhee, Neil S., . . .	Gloucester, . . .	Louisa Polleys.
Merchant, Fred, . . .	Salem, . . .	Evangeline.
Mesquita, Joseph, . . .	Gloucester, . . .	Francis P. Mesquita.
Miller, Mark, & Co., . . .	Salisbury, . . .	(Dory.)
Milton, Manifred, . . .	Newburyport, . . .	(Dory.)
Mitting, Theodore, . . .	Newburyport, . . .	(Dory.)
Morgan, George B., . . .	Lanesville, . . .	Star Spangled Banner.
Morris, Edward, . . .	Gloucester, . . .	Miranda.
Morrissey, William F., . . .	Gloucester, . . .	Helen F. Whitten.
Morse, Bartholomew, . . .	Beverly, . . .	(Gasoline boat.)
Morse, George F., . . .	Newburyport, . . .	(Gasoline boat.)
Mosoetic, John, . . .	Gloucester, . . .	Nettie.
Murray, Thomas F., . . .	Gloucester, . . .	Mary A. Gleason.
Nauss, Robert, . . .	Gloucester, . . .	Lizzie M. Stanley.
Neil, Valentine D., . . .	East Boston, . . .	Elmer E. Gray.
Nelson, Charles, . . .	Gloucester, . . .	Mary Emerson.
Nelson, Hans, . . .	Gloucester, . . .	Lorna Doone.
Nelson, Henry, . . .	Gloucester, . . .	(Trap.)
Nelson, John, . . .	Gloucester, . . .	Reliance.
Nelson, Niles, . . .	East Brewster, . . .	(Seven dories.)
Newell, W., . . .	Gloucester, . . .	Vesta.
Newhall, W. H., . . .	Gloucester, . . .	Canopus.

NAME.	Town.	Name of Vessel.
Nickerson, C. E., . . .	Gloucester, . . .	Maud M. Story.
Nickerson, Eldridge, . . .	Boston, . . .	Ellen C. Burke.
Nickerson, Eldridge C., . . .	Boston, . . .	Quannapowitt.
Nickerson, Enos, . . .	Boston, . . .	Seaconnet.
Nickerson, Erastus, . . .	Boston, . . .	Bertha M. Bailey.
Nickerson, Herbert, . . .	Malden, . . .	Buema.
Nickerson, H. F. & E. K., . . .	South Chatham, . . .	Corsair.
Nickerson, Jethu W., . . .	Boston, . . .	Flora S. Nickerson.
Nickerson, Josiah, . . .	Swampscott, . . .	(Dory.)
Nickerson, Phillip L., . . .	Harwichport, . . .	(Sail boat.)
Nolan, Frank, . . .	Gloucester, . . .	Actor.
Norris, Larance, . . .	Boston, . . .	Mary A. Whalen.
Norwood, John H., . . .	Gloucester, . . .	(Boat 20 feet.)
Obed, William J., . . .	Boston, . . .	Catherine G. Howard.
O'Brien, John, . . .	Boston, . . .	Mattakesett.
Olson, Lars, . . .	Gloucester, . . .	Julietta.
O'Neal, George R., . . .	Provincetown, . . .	Lucy B. Winsor
O'Neil, Charles, . . .	Gloucester, . . .	Valentina.
O'Neill, Dennis, . . .	East Boston, . . .	Fanny E. Prescott.
Pail, Joe, . . .	Provincetown, . . .	(Power dory.)
Parks, George M., . . .	Gloucester, . . .	Thistle.
Parsons, Samuel, . . .	Rockport, . . .	Queen of the Sea.
Paul, Antone, . . .	Provincetown, . . .	(Power dory.)
Paul, Frank, . . .	Provincetown, . . .	(Power dory.)
Paul, George, . . .	Salisbury, . . .	(Gasoline boat.)
Paulsen, Gussie, . . .	Provincetown, . . .	Perseverance.
Peabody, William, . . .	Salem, . . .	(Dory.)
Pennington, A. H., . . .	Gloucester, . . .	Motor.
Pennur, Austin, . . .	Boston, . . .	A. C. Newhall.
Peoples, George, . . .	Gloucester, . . .	Lafayette.
Perry, George H., . . .	Boston, . . .	Teresa and Alice.
Perry, Manuell F., 2d, . . .	Gloucester, . . .	Two Sisters.
Perry, Marian, . . .	Provincetown, . . .	Annie Perry.
Peterson, Edward, . . .	Boston, . . .	Elsie Rowe.

NAME.	Town.	Name of Vessel.
Peterson, Gustaf, . . .	Gloucester, . . .	Corona.
Peterson, Henry, . . .	Gloucester, . . .	Maud B. Murray.
Pettipas, Joseph, . . .	Boston, . . .	Nokomis.
Phillips, Edward C., . . .	Swampscott, . . .	(Dory.)
Phillips, Henry, . . .	Green Harbor, . . .	- -
Phillips, William B., . . .	Swampscott, . . .	Pioneer.
Pierce, James L., . . .	Marblehead, . . .	(Dory.)
Pierce, John, . . .	Marblehead, . . .	(Dory.)
Pierce, John D., . . .	Marblehead, . . .	(Dory.)
Pierce, Nathaniel, . . .	Swampscott, . . .	(Dory.)
Pierce, Richard, . . .	Newburyport, . . .	(Gasoline boat.)
Pierce, William, . . .	Salisbury, . . .	(Dory.)
Pike, Gustavius, . . .	Newburyport, . . .	(Dory.)
Poor, Harold C., . . .	Ipswich, . . .	(Gasoline boat.)
Porper, Robert B., . . .	Gloucester, . . .	Cavalier.
Post, John, . . .	Ipswich, . . .	(Gasoline boat.)
Potter, Charles, . . .	Boston, . . .	Sarah C. Wharf.
Powers, Michael, . . .	Boston, . . .	Benjamin F. Phillips.
Price, William, . . .	Duxbury, . . .	Manomet.
Prior, Elroy, . . .	Gloucester, . . .	Kentucky.
Proctor, Edward A., . . .	Salem, . . .	Florida.
Proctor, James, . . .	Plymouth, . . .	Minerva.
Publicover, E., . . .	Boston, . . .	Gertrude.
Quinlan, Hugh, . . .	Duxbury, . . .	Mooanam.
Radcliff, Amos N., . . .	Swampscott, . . .	Venus.
Real, Chauncey, . . .	Salem, . . .	(Dory.)
Rhodes, Peter, . . .	Ipswich, . . .	(Dory.)
Rich, Edward S., . . .	Salisbury, . . .	(Gasoline boat.)
Rich, Henry, . . .	Newburyport, . . .	(Gasoline boat.)
Riley, Alfred W., . . .	Lanesville, . . .	(Gasoline dory.)
Robbins, John F., . . .	Duxbury, . . .	Matamora.
Roberts, Isaiah, . . .	Gloucester, . . .	Electric.
Roberts, Walter, . . .	Salem, . . .	Venus.
Roberts, Wilfred, . . .	Boston, . . .	Susan and May.

NAME.	Town.	Name of Vessel.
Robinson, Robert, . . .	Gloucester, . . .	Jack O'Lantern.
Rogers, Ensign, . . .	Dennis, . . .	L. Ellouse.
Rogers, Frank V., . . .	Boston, . . .	Hattie F. Knowlton.
Rose, Charles F., . . .	Gloucester, . . .	J. F. McMorrow.
Rose, Edward, . . .	Lanesville, . . .	(Gasoline dory.)
Rose, Emanuel J., . . .	Gloucester, . . .	Laura Enos.
Ryder, Albert G., . . .	West Chatham, . . .	Searey.
Sampson, James R., . . .	Plymouth, . . .	Rose Standish.
Sanger, Antone, 2d, . . .	Provincetown, . . .	(Power dory.)
Santos, Frank, . . .	Provincetown, . . .	(Power dory.)
Santos, Joe, . . .	Provincetown, . . .	(Power dory.)
Santos, Manuel D., . . .	Provincetown, . . .	(Power dory.)
Santos, Manuel, . . .	Provincetown, . . .	Mary C. Santos.
Sants, John, . . .	Provincetown, . . .	(Power dory.)
Sater, John, . . .	New Bedford, . . .	Viking.
Sattime, Charles F., . . .	Newburyport, . . .	Neptune.
Scase, Joseph, . . .	Gloucester, . . .	Oliver Sears.
Scuola, Giovanni, . . .	Boston, . . .	Sea Foam.
Sears, Frank I., . . .	Provincetown, . . .	Dart.
Sears, Joseph, Sr., . . .	Provincetown, . . .	(Sail dory.)
Sears, J. W., . . .	Provincetown, . . .	-
Seartz, John R., . . .	Provincetown, . . .	Climax.
Seaton, Jule, . . .	Provincetown, . . .	(Power dory.)
Seeley, Elias, . . .	Beverly, . . .	Lydia.
Selig, Adam A., . . .	Gloucester, . . .	Titania.
Selig, Edward, . . .	Gloucester, . . .	Estelle Nunan.
Selig, William J., . . .	Boston, . . .	Emma W. Brown.
Shea, Jeremiah, . . .	Boston, . . .	Regina.
Shea, P. T., . . .	Gloucester, . . .	Colonial.
Sherman, Charles, . . .	Newburyport, . . .	(Dory.)
Short, George G., . . .	Newburyport, . . .	Joppaite.
Short, George G., . . .	Newburyport, . . .	(Gasoline boat.)
Silva, Antone, . . .	Provincetown, . . .	Lewis Warren.
Silva, Antone C., . . .	Provincetown, . . .	M. L. Adams.

NAME.	Town.	Name of Vessel.
Silva, Henry P., . . .	Provincetown, . . .	Dido.
Silva, John,	Provincetown, . . .	J. P. Johnson.
Silva, John 2d, . . .	Rockport,	Maud F. Silva.
Silva, John F., . . .	Provincetown, . . .	Magnolia.
Silva, Joseph,	Boston,	Ida M. Silva.
Silva, Joseph S., . . .	Provincetown, . . .	Louisa R. Sylva.
Silva, Jule Fratus, . .	Provincetown, . . .	(Power dory.)
Silva, Manuel,	Provincetown, . . .	Columbia.
Silvata, John J., . . .	Boston,	Evelyn L. Smith.
Silveira, James, . . .	Boston,	Mary C. Silveira.
Silvera, Joaquin J., . .	Boston,	Flora J. Sears.
Slade, Joseph,	Manchester,	(Dory.)
Sloan, William, . . .	Gloucester,	A. D. Story.
Small, John,	Ipswich,	(Gasoline boat.)
Small, John,	Provincetown, . . .	(Power dory.)
Small, Samuel S., . . .	Ipswich (Grape Island),	(Gasoline boat.)
Smith, Charles H., . . .	Gloucester,	Nautilus.
Smith, Elmer,	Ipswich,	(Gasoline boat.)
Smith, George,	Gloucester,	Fannie A. Smith.
Smith, James,	Gloucester,	Torpedo.
Smith, Joseph,	Gloucester,	Bertha and Pearl.
Smith, Nathaniel P., . .	Gloucester,	Margie Smith.
Smith, William,	Newport, R. I., . . .	Gypsy Maid.
Somers, Miles,	Gloucester,	Preceptor.
Sousa, Antonio K., . . .	Provincetown, . . .	P. P. Manta.
Souther, George M., . .	Newburyport, . . .	(Dory.)
Southwick, Nicholas, . .	Beverly,	(Dory.)
Sperry, James W., . . .	Gloucester,	Fly.
Spinney, Adolphus, . . .	Gloucester,	Orpheus.
Spinney, F. M.,	Gloucester,	Senator.
Spinney, Lemuel E., . . .	Gloucester,	American.
Spinney, M.,	Gloucester,	Blue Jacket.
Spinney, Wilson,	Gloucester,	Arbitrator.
Stanley, Ed.,	Beverly,	Viola.

NAME.	Town.	Name of Vessel.
Stanley, Joshua W., . . .	Boston,	Elizabeth Silsbee.
Steele, George F., . . .	Gloucester,	Selena.
Stevens, William, . . .	Newburyport, . . .	(Gasoline boat.)
Stoddard, William, . . .	Boston,	Fame.
Stone, Silas,	Ipswich,	(Dory.)
Story, Albert,	Rockport,	(Trap.)
Stover, Woodbury P., . .	Beverly,	Frank Munroe.
Stream, Frank,	Gloucester,	Waldo L. Stream.
Stream, John G.,	Gloucester,	Kineo.
Sweat, Manuel,	Provincetown, . . .	- -
Swenson, August,	Gloucester,	Niagara.
Swift, Bob,	Plymouth,	- -
Swim, Benjamin,	Boston,	Hope.
Tallgrew, Peter T., . . .	Duxbury,	Tecumseh.
Tarr, Frank A.,	Gloucester,	Myrtle.
Tarr, George H.,	Rockport,	Lena May.
Tarvers, Antone,	Provincetown, . . .	(Power dory.)
Thing, Ernest,	Swampscott,	(Dory.)
Thomas, Jeffrey,	Gloucester,	Arcadia.
Thomas, William H., . . .	Gloucester,	Thomas L. Gorton.
Thomas, W. R.,	Plymouth,	Allons.
Thompson, John,	Boston,	Mary Edith.
Thompson, John W., . . .	Gloucester,	Carrie E.
Thurlow, George,	Newburyport, . . .	(Dory.)
Thurlow, George F., . . .	Newburyport, . . .	(Dory.)
Thurlow, James H., . . .	Newburyport, . . .	(Dory.)
Thurlow, Joseph,	Newburyport, . . .	(Dory.)
Thurlow, Nestor,	Newburyport, . . .	(Dory.)
Thurlow, Sydney,	Newburyport, . . .	(Gasoline boat.)
Tobin, Richard,	Boston,	Margaret Dillon.
Tolman, W. H.,	Green Harbor, . . .	- -
Turner, George,	Gloucester,	Blanche Irving.
Tutt, William,	Marblehead,	(Dory.)
Tyler, Isaac J.,	Provincetown, . . .	I. Tyler.

NAME.	Town.	Name of Vessel.
Vale, Patsy,	Gloucester,	Pauline.
Valyoke, Peter,	Provincetown,	(Sail dory.)
Vera, Manuel P.,	Provincetown,	Ira P. Hatch.
Viator, Fortune,	Beverly,	Oliver Kilham.
Viator, Manuel F.,	Gloucester,	Mary E. Stone.
Wareham, William M.,	Provincetown,	Rattlier.
Warren, Jed,	Gloucester,	Richard Lester.
Watts, Frederick,	Swampscott,	(Dory.)
Webber, Ralph,	Gloucester,	Marguerite.
Weeks, E. O.,	Provincetown,	Sylvia.
Weeks, Joseph E.,	Provincetown,	Grace Darling.
Welch, Martin,	Gloucester,	Lucania.
Wells, Edward E.,	Ipswich,	(Gasoline boat.)
West, John,	Manchester,	(Dory.)
Wetcel, Frank,	Lanesville,	Fussy.
Whalen, Maurice,	Gloucester,	Vera.
Whelden, Edna A.,	Provincetown,	(Sail dory.)
White, Antonio,	Provincetown,	William A. Morse.
White, Charles,	Gloucester,	Joseph W. Lufkin.
Whitten, Owen,	Gloucester,	Ralph Russel.
Whitney, Walter,	Gloucester,	Agnes V. Gleason.
Whorf, H. S.,	Provincetown,	Daniel Boone.
Wildes, Lyman,	Gloucester,	Olga.
Wiley, Freeman,	Gloucester,	Messenger.
Wilkie, Henry M.,	Gloucester,	Columbia.
Wilkie, James,	Newburyport,	(Gasoline boat.)
Willett, Peter A.,	Gloucester,	Freedom.
William, John,	Provincetown,	(Power dory.)
Williams, Bernard A.,	Gloucester,	John S. Presson.
Williams, John C.,	Gloucester,	Norman Fisher.
Winkpaw, Alden,	Gloucester,	Little Fannie.
Wolfe, Fred,	Boston,	Priscilla.
Wolfe, William J.,	Provincetown,	H. M. Young.
Woodman, George F.,	Newburyport,	(Gasoline boat.)

NAME.	Town.	Name of Vessel.
Woodbury, Elbridge, . . .	Lanesville, . . .	Charles A. Dyer.
Woodbury, John J., . . .	Lanesville, . . .	(Power dory.)
Woods, John P., . . .	Provincetown, . . .	Handy Andy.
Woods, Stephen, . . .	Provincetown, . . .	(Power dory.)
Woodward, H. F., . . .	Salisbury, . . .	(Dory.)
Wright, William, . . .	Newburyport, . . .	(Gasoline boat.)
Wylde, Horace, . . .	Gloucester, . . .	Dictator.
Yates, Charles A., . . .	Newport, R. I., . . .	Olive E.
Young, Fred, . . .	Brewster, . . .	(Two dories.)
Young, J. E., . . .	South Chatham, . . .	Mayflower.

Returns were received from the following localities, and they include all the various types of sea fisheries carried on from Massachusetts territory:—

Barnstable,	1	Lanesville,	10
Beverly,	20	Malden,	1
Boston,	63	Manchester,	8
Brant Rock,	1	Marblehead,	11
Brewster,	3	New Bedford,	3
Chatham,	3	Newburyport,	43
Chathamport,	1	Newport, R. I.,	5
Dennis,	1	Provincetown,	82
Duxbury,	8	Plymouth,	6
East Boston,	2	Rockport,	19
East Brewster,	4	Salem,	7
East Dennis,	1	Salisbury,	12
Essex	6	South Chatham,	6
Gloucester,	195	Swampscott,	21
Green Harbor,	4	West Chatham,	2
Harwichport,	2	Yarmouth,	1
Ipswich,	29		

Under the head of "Remarks," in the replies to the circular, the following are fair examples of the various opinions expressed by the fishermen:—

It is almost impossible to fish with trawls or nets in Ipswich or Massachusetts bays during the summer months, on account of dogfish. (Elbridge Woodbury, Lanesville, schooner "Charles A. Dyer.")

Have not been able to fish for food fish other than lobsters during the past five years during the summer months. Catch dogfish in lobster pots occasionally. (Albert J. Griffin, Lanesville, gasoline dory "Alice," 2 men.)

Have been fishing for dogfish off and on for about two or three years, and could not make a success. (George Harriden, Lanesville, sail dory, 1 man.)

We could not fish with any success in June and July with trawls, or hand line in August, dogfish were so plenty. Tried to set out trawls about two weeks ago, and got dogfish on every other hook, and had to give up. (Frank Weteel, Lanesville, sloop "Fussy," 1 to 3 men.)

In August, 1904, we went fishing expressly for dogfish; we were gone three weeks, and secured 60 barrels of livers, realizing \$180 for same, and shared \$30 each. It was hard work, and the dogfish were extra large in size,—about 17 to a bucket of livers. It hardly paid us, as the expense was very much, and if the dogfish were of average size or smaller, we would have had a lot of hard work with little pay. In 1902 we went over to Ipswich River after herring, and dogfish were so plenty they destroyed our nets. Dogfish were never known to be found in this river before, to my knowledge. They come earlier each year. (Benjamin Bowden, Lanesville, schooner "Venus," 4 to 6 men.)

We go south netting mackerel every spring in April, and sometimes we strike dogfish as soon as we get on the fishing grounds, we always find them soon after; and from then until we return to Gloucester, which is usually about July 1, they are a constant pest. They eat our fish and destroy our nets, and we lose a great amount of time on account of them. They are so plenty in Massachusetts Bay during the summer months that we cannot pursue any fishing except sword-fishing, which we go at until about September 15. Then we go hand-lining for pollock, and are annoyed constantly until November 1, and sometimes later. (John W. Keefe, Gloucester, sloop "Diana," 6 to 8 men.)

Go hand-lining on Georges all the year. From May until November dogfish are such a pest that we are constantly going from one end of the fishing grounds to the other to get clear of them. They are constantly increasing, and getting more of a pest each year. (Samuel Crittenden, Gloucester, schooner "Mattie Winship," 13 men.)

Go south every spring netting mackerel, and have to contend with dogfish constantly. Cannot fish for mackerel with nets in Massachusetts Bay during summer months, as dogfish are so numerous. (Robert Robinson, Gloucester, sloop "Jack-O'Lantern," 3 men.)

We fish on the "Rips," and dogfish are very plenty there; if we used any bait other than cockles, we could not fish. The past year dogfish are eating cockles more than I ever saw them before, and we

caught more. We start pollocking about September 20, and dogfish eat at least one-half our bait, and drive us from the grounds at times. (Benjamin Goodwin, Gloucester, schooner "Braganza," 17 men.)

Started Sept. 10, 1905, to fish for pollock on Jeffrey's. Dogfish were so numerous that if it had not been for another vessel in the vicinity we would have had to return without any fish, as the dogfish ate our hooks off our lines. We had a good supply of hooks. By getting hooks from our neighbor we managed to catch fish enough to pay our expenses. Although we have done fairly well to date, the dogfish have been an awful pest to us, and are more numerous this fall than I ever saw them. (Norman Devine, Gloucester, schooner "James A. Garfield," 14 men.)

Sometimes when we are setting our trawls we feel the dogfish biting and haul right back to save the gear, and we lose that day's fishing. (Joseph P. Mesquita, Gloucester, "Frances P. Mesquita.")

Dogfish are constantly increasing, and when there are any mackerel in Massachusetts Bay it is almost impossible to catch them and save them without losing a large quantity. They come earlier and stay later each year. (Alex McLoud, Gloucester, schooner "Leander F. Gould," 14 to 17 men.)

About April 10 the past few years dogfish make their appearance on the grounds where we fish, and are a constant pest to us more or less until January 1. They eat our bait, and sometimes before we can get many food fish our supply of bait is gone, and we have to return with a small fare. They seem to be getting more numerous each year. (William Sloan, Gloucester, schooner "Arthur D. Story," 15 men.)

We have to go farther to the eastward each year, to get clear of dogfish. When we first went to the eastward there were none there, but the last few years they are getting as plenty there as elsewhere. (James D. Goodwin, Gloucester, schooner "Ella G. Goodwin," 22 men.)

Have been fishing about Massachusetts Bay for thirty years, and dogfish seem to be getting more numerous each year. They come earlier and stay later each season. In a few years there will be no food fish, if they continue to constantly increase. (George L. Gross, Gloucester, schooner "Priscilla," 16 men.)

Go seining each year, and have always caught more or less dogfish with mackerel, except this year, 1905. I believe there are more dogfish than ever before, although we have had the good fortune to escape them. A few years ago we had about 100 barrels of mackerel in our seine, and before our vessel got to us the dogfish attacked the fish on the outside and ate the twine, so they all escaped but 5 barrels. Our seine was greatly damaged, so we had to give up the trip and return and get it repaired, at an expense of \$300. (Joseph Smith, Gloucester, schooner "Bertha and Pearl," 18 men.)

In the years 1899-1901 our floating trap was set at the Breakers, Marblehead. We would get a few dogfish, and they caused serious loss to us of food and bait for fish, besides damaging our trap. Their presence about a trap will keep all other fish away, and when any small fish are meshed in our leader of trap, dogfish will eat them and the twine also. (Thomas Douglass, Gloucester.)

In the year 1903, during the months of June, July and August, dogfish struck in, and our floating traps were filled with them on 20 occasions; we were bothered in fishing and our traps were damaged very much. In 1904 it was the same. This year we have only caught a few, as they have not come close enough to the shore. Their presence keeps all other fish from the shore, and when they are about it is impossible to catch other fish. (Frank A. Tarr, Gloucester, gasoline boat "Myrtle," 3 men.)

We usually fish with cockles, and dogfish do not like them very well. One trip we could not get cockles on our second baiting, so we took herring. Codfish were quite plenty when the dogfish struck, and after making about 200 attempts we had to come home, as our bait was all eaten by dogfish. (W. H. Lyons, Gloucester, schooner "Wm. H. Ryder," 16 men.)

Usually find dogfish about the first of May off New York, and then all along the Massachusetts coast during the summer months. The more mackerel there are, the more dogfish. (Albert Hudder, Gloucester, schooner "A. M. Nicholson," 18 men.)

Dogfish have possession of the Massachusetts coast in summer months. After returning from the southern mackerel fishery, July 1, I had to haul up for two months. Started hand-lining about September 1, and have not been very successful yet, as dogfish are quite numerous, and have driven us around the grounds. The last trip we made 4 berths and returned with very few fish. (Robert B. Benham, Gloucester, schooner "Lizzie W. Hunt," 4 men.)

Left Gloucester for southern mackerel fishery (which means to southward of Cape Cod) on April 22, 1905. Set our nets about May 1. off Jersey coast; dogfish so plenty we could do no fishing for a week. Fished off Fire Island from 10 to 30 miles, and did very well, although we were bothered a great deal. On June 1 fished off Noman's Land, and dogfish and sharks were very destructive to our nets. Have examined some of the contents of dogfish stomachs, and found it to be mackerel. In September, 1904, we set 60 nets off Thatcher's Island, 5 miles, at 6 P.M.; good prospects for mackerel. Dogfish struck at 7 P.M. Twenty hours getting our nets on board boats. Nets mended during leisure time in winter; used 36 twine, \$12; patches, \$12; damage, \$350, if hired done. (John F. Barrett, Gloucester, schooner "Lillian," 7 to 10 men.)

We are bothered more or less with dogfish, and at times during the summer we have hard work to save mackerel that we have in our seine, as the dogfish attack them from the outside, and liberate them at times in large numbers. When we start trawling in the early fall we are annoyed by them very much. They are not getting any scarcer each year. (Thomas Downie, Gloucester, schooner "Monarch," 20 men.)

On 20 occasions we have set our trawls and the bait has been eaten by small dogfish, which were hardly large enough to get on our hooks. On one occasion not a food fish was captured, — something which has never been known before. (Freeman Wiley, Gloucester, sloop "Messenger," 2 to 4 men.)

I have been fishing the past years to the eastward of Cape Sable, and never saw any dogfish to speak of until about two years ago, and

they have been quite plenty at times during the last two seasons. This fall we were getting fair fishing and catching some squid every night to use for bait, when dogfish appeared, driving away the squid. We were forced to go to Nova Scotia for bait, and we could not get any. We had to return home with a small fare. (Adolphus Spinney, Gloucester, "Orpheus," 18 men.)

We fish for mackerel in the spring and during the summer, and dogfish are an awful pest to us. Last summer, 1905, we had a school of mackerel in our seine, and as it was calm the vessel was a long while getting to us, and dogfish attacked our seine and liberated the mackerel, valued at \$2,000, besides doing about \$125 damage to our seine. When we start trawling in the fall we are bothered more or less with them. Only last trip we set our trawls (about 40,000 hooks) and got a dogfish on nearly every hook, or the bait was gone. (Martin Welch, Gloucester, "Lucania," 23 men.)

We fish with hand lines on Georges, Browns, La Have, Western banks and Scatterie. Dogfish are getting more numerous each year. In the fall they drive the squid from the bank, and prevent us from getting trips as we used to a few years ago. (James McDonald, Gloucester, "Edwin B. Holmes," 13 men.)

In the month of June, 1905, we were fishing with cod nets in Ipswich Bay, and getting a fair catch of codfish each day. Dogfish struck, and we were forced to abandon the fishing. It is almost impossible to fish in Massachusetts Bay during the summer months. (Charles H. Smith, Gloucester, "Nautilus," 3 to 4 men.)

In the month of September, 1903, we set 45 mackerel nets at 6 P.M., about 8 miles east from Thatcher's Island. Dogfish struck at 7 P.M. We began to haul back the nets, and got our nets on board and free from dogfish at 10 A.M. the next day. Damage estimated at \$2 per net, 50 mackerel saved. The dogfish were very small, and weighed about 1 pound each. In the year 1904, in the months of July and August, similar conditions existed. This year, 1905, have not dared to take a chance to fish for mackerel with nets, and have been sword-fishing. (Sven Hanson, Gloucester, "Sylvester," 4 to 5 men.)

We fish on Scatterie, Quero, Western banks, Grand Banks, and dogfish seem to be on the increase each year. They do considerable damage to our fishing gear, and at times we lose a great amount of time on account of them. I believe the presence of dogfish on the fishing grounds the past few years has kept us from getting our regular supply of squid on our fall trips. We left the banks November 23, and they were quite numerous then. (Warren Forbes, Gloucester, "Alicie R. Lawson," 18 men.)

Dogfish are getting more numerous each year, and we have to go farther to the northward and eastward to get clear of them. A few years ago we hardly knew what it was to catch dogfish on the Banks where we fished. When they are present we can't get any squid. (William F. Morrissey, Gloucester, "Helen F. Whitten," 18 men.)

Generally find them off Jersey coast about May 1, and then they are a pest to us all summer, and have been the past ten years. (Solomon Jacobs, Gloucester, "Veda M. McKnoven," 20 men.)

Almost impossible to set cod nets or mackerel nets in Massachusetts

or Ipswich bays after first of June, and has been the past five years. They eat bait and hooks off hand lines as fast as you can put them on, in the fall, when they are about to any extent. (James A. Jewett, Gloucester, schooner "Grace E. Freeman," 4 to 6 men.)

Have tried to drag for mackerel this summer on 6 occasions. No mackerel, and plenty of dogfish. Had to quit, on account of dogfish. The last time, July 20, our nets were in the water only one hour, and after hauling them on board of boat it required ten hours to overhaul nets and pick out the dogfish. Same the past five years in Massachusetts and Ipswich bays. (George M. Parks, Gloucester, sloop "Thistle," 3 men.)

Start for southern mackerel fishery with nets about April 15 to 20 each year, and usually find dogfish May 1 off Jersey coast, and from then until we return to Gloucester we have to try and dodge them all along the coast. They are getting more numerous each year. Return about July 1, and go hand-line fishing until December 1 to 25. The dogfish are a pest, and do not leave until about November 1. This year this month [September] they are driving us all over fishing grounds daily. (James W. Hemeon, Gloucester, schooner "Matta-comet," 10 men.)

We go netting codfish until dogfish strike, which usually is in May or June. Then we have to get out of it, as the dogfish seem to be everywhere along our coast. Five or ten years ago we could dodge them, and sometimes they would stay on the shore a week or so, and then move on. Of late years they seem to have come to stay during the months of May, June, July, August and September. (Henry C. Lufkin, Gloucester, sloop "Esther Madelene," 3 men.)

We hand line on Georges, Browns and La Have banks all the year. We get dogfish about April 1, and all through the summer and fall until January. They cause us lots of trouble, as we are driven all over the fishing grounds by them, losing a great amount of time, and, as they eat a large amount of our bait, quite often our supply runs short, and we have to return with small fares. (Andrew Gonvreau, Gloucester, schooner "Wm. H. Moody," 15 men.)

We start for the southern mackerel fishery about April 15 to 20, and about May 1 we most always are attacked by dogfish. They chase the fish, and it is hard work to keep clear from them. We return to Gloucester about July 1, and, as dogfish are numerous in Massachusetts Bay during the summer months, we can't fish with our nets. Last spring we had the webs of 30 new nets valued at \$180, completely eaten up. After September 15 we go hand lining for pollock, and dogfish are quite plenty until November 1, and sometimes later. They eat at least one-half of our bait, and are a constant pest. (George Peoples, Gloucester, schooner "Lafayette," 7 to 10 men.)

We have not been bothered the past two years with dogfish as much as we have been previously. We go a trip sword-fishing during the dogfish season; we have caught a great many more food fish this summer than ever before, and prices have ruled lower. We made a set off Highlands in June this year, and our trawls were attacked by dogfish; we estimate that 20,000 pounds of food fish were destroyed. (Thomas F. Murray, Gloucester, schooner "Mary A. Gleason," 14 men.)

We always made a good season's work with our floating trap up to five years ago; since that time we can't make a living. Mackerel and bait do not seem to come in shore as usual. I believe that the school of dogfish which has been so constant and numerous in our bay the past five years has kept the food fish away. (George W. Douglass, Gloucester, schooner "Mary Elizabeth," 3 men.)

Bait very scarce, so did very little fishing this summer, 1905. Same in 1904. In July, August and September, 1903, made several attempts to fish in the bay, but had to give up on account of dogfish. (John J. Woodbury, Gloucester, Lanesville, large power dory, 1 to 2 men.)

We usually find dogfish about June 1, off Block Island. They follow the mackerel up along the channel into Boston Bay, and in July Massachusetts Bay is full of dogfish. They harass the mackerel, and it is almost impossible to catch a large school and get them on board without suffering great damage and loss of fish when dogfish are about. It is an ordinary affair to have dogfish attack a seine and liberate two or three thousand dollars' worth of fish, when dogfish are numerous. (Frank Hall, Gloucester, schooner "Ralph L. Hall," 19 men.)

We find dogfish mixed with mackerel as soon as we get on the southern fishing grounds each year, and they are a menace to us all the season. There is not so much danger from them inside the seine as there is on the outside. Our seine has often been attacked by dogfish from the outside, and we have lost a great many fish. (Joseph A. Lyle, Gloucester, "Norumahal," 18 men.)

I have been fishing off Eastern Point the past twenty years, and dogfish have got so numerous the past few years that it is almost impossible to earn anything during the summer months. Up to a few years ago we could earn from \$400 to \$500 a season, but the past few years it has been much less, so that I shall have to give up fishing and work on shore. (John H. Norwood, Gloucester, boat 20 feet long, 1 man.)

On Sept. 12, 1905, we were fishing on Western Jeffreys. We were getting fair fishing when dogfish struck, and after making 3 or 4 berths of about a mile each we were forced to give up and return to port. (John Mosoetic, Gloucester, "Nettie," 3 to 4 men.)

On June 10, 1904, we set 40 mackerel nets at 7 P.M. In half an hour the dogfish struck, and we started to haul our nets, and got them on board at 9 A.M. the next day. Time consumed, 14 hours; time lost in repairing, 4 days; damage estimated, \$100. Location, 5 miles east of Noman's Land. (Capt. Benj. Hanson, Gloucester, "On Time," 4 to 5 men.)

We fish for halibut and other fish on banks to eastward of Cape Sable from March until September. Dogfish were hardly known to us up to three years ago, and since then they have been becoming more numerous each season, until now they are a pest, and we lose a lot of time, fishing gear and food fish by their presence. In September we start to fish for haddock, cod and other food fish and we have been fishing from Jeffrey's to Liverpool, N. S. There are more dogfish this fall than I ever saw. On this trip off Jeffrey's, December 1, we could not fish for them, and a few days later farther to the eastward we caught at least 40,000. On one day our gear contained food-

fish heads enough to estimate loss at \$500, together with \$25 damage to trawls. (Capt. F. M. Spinney, Gloucester, "Senator," 20 men.)

We get dogfish mixed with mackerel in the spring off New York in May, and continue to do so all the season until October. They are a great menace, and are getting worse all the time. Sometimes they attack our seine from the outside when we have a good haul of fish, and chew the twine and liberate them. (George Hamor, Gloucester, "Corsair," 18 to 19 men.)

Last summer we lost at least 20 tubs of trawls on account of dogfish. During the summer season we catch as many dogfish as we do food fish. Sometimes, after making a small trip on account of dogfish being so numerous, the crew get discouraged, and we have to wait to get a crew; if a bounty was paid, it would relieve this. (Charles C. Malone, Gloucester, "Orinoco," 22 men.)

Last fall dogfish attacked the herring in our nets, and destroyed both the fish and nets. When we arrive off New York where we fish for mackerel we usually find more or less dogfish, and continue to do so all the season; and during the summer it has been almost impossible to fish with nets the past few years in Massachusetts Bay. This fall to date we have been fishing around Block Island, and have seen more dogfish the past two months than I ever saw at any time in my experience. (Silas Jewett, Gloucester, schooner "Arrow," 10 men.)

For the past few years we have had to go farther to the eastward each year during the summer and fall to get clear of the dogfish, as they have been so numerous on the regular grounds that it is impossible to fish at times. This year we found them numerous on Flemish Cap, the first time I ever saw any there. They are the worst pest that the fishermen have to contend with. (Lemuel E. Spinney, Gloucester, schooner "American," 20 men.)

We start for southern mackerel fishery with nets in the spring, and usually find dogfish off New York; and from the time we first find them it is hard work to keep clear from them during the season. If we are fortunate enough to do so, we always make a good trip. About September 10 we start hand lining, and they are very numerous, and seem to be more so each year. Two years ago we were fishing with 50 nets, and had taken 1,400 mackerel from 15 nets, when dogfish struck, and all the fish in the remaining nets were destroyed, together with the nets. The fish sold for 18 cents each. (Gilbert Gillant, Gloucester, schooner "F. W. Homans," 14 to 16 men.)

We are bothered more or less with dogfish from spring until fall. We are always in dread of them, as they do considerable damage to our seines. The part we fear the most is the attack from the outside after we have caught the mackerel in our seine, as we often have a school of great value. (Charles Harty, Gloucester, "Mary E. Harty," 19 men.)

Up to a few years ago dogfish were not found to any extent on Flemish Cap or the Grand Banks, but the past two years they have been a terrible pest, especially on Grand Banks. Have been jigging squid for bait, when dogfish would appear and drive them away. This is a great detriment, as we depend on squid mostly for bait, and since dogfish have appeared on the banks we can't get squid as we used to. (Capt. Alex Hains, Gloucester, "Meteor," 18 men.)

We fish on Grand Bank, Quero, Green St. Peter's, Sable Island and La Have banks, and a few years ago we never were bothered with dogfish; now they are so numerous that we have to go farther each year to get clear of them. This trip on Scatterie Bank there were good prospects for fish, as we were jigging squid for bait and getting fair fishing. Dogfish struck, drove the squid, and after making several attempts to find a place where they were not, we had to return with only a partial fare of food fish. (Roderick McNeil, Gloucester, "Senator Salisbury," 16 to 18 men.)

Always fished to eastward of Cape Sable, and never saw any dogfish to amount to much until a few years ago. This year was the worst I ever saw. The last day we fished we set 21 tubs of trawl, representing 14,700 hooks, and they were in the water three hours when dogfish attacked the bait, and before we could haul them we lost 8 tubs, valued at \$40. Hooks and gangings on balance of trawls were destroyed to the amount of \$25, together with \$200 worth of fish eaten, and it took two days to repair our gear so we could fish again. (Capt. Alex McEachen, Gloucester, schooner "Maggie and May," 18 men.)

This spring we caught a school of mackerel and dogfish, and after we had picked out the mackerel we had about 100 barrels of dogfish left. It consumed a great deal of time, and we had some damage done to the fish and our seine. Last year we lost at least \$2,000 worth of fish by dogfish attacking our seine on the outside after we had mackerel in it. In the fall when we are fishing for pollock we are bothered more or less the first of the season. (Ralph Webber, Gloucester, schooner "Marguerite Haskins," 18 men.)

I have been hand lining on Georges, Browns, La Have and Western banks for thirty years, and dogfish are getting so plenty that at times it is almost impossible to fish, and we have to return with small trips. They seem to come earlier and stay later each year. There are times when we could lay and fish on a small quantity of fish, but dogfish eat our bait before we can get a fair trip. I think we could make at least \$50 more per man each season if we were not bothered so much with dogfish. (Benjamin Johnson, Gloucester, schooner "Lawrence Murdock," 14 men.)

It is my opinion that when dogfish are plenty we make more money, as there is less edible fish landed, and we get higher prices. Last spring on one trip we lost 20 tubs of trawls, valued at about \$140, by the dogfish. It is my opinion that a bounty of 1 cent a fish would not encourage the fishermen to catch them. (J. O. Brigham, Boston, "Shepherd King.")

It is my opinion that the price received for the dogfish would not pay us to save them. (Julius Anderson, Boston, schooner "Robert and Arthur.")

In August, 1905, we set 40 nets just southeast of Thatcher's Island, 5 miles, at 7 P.M. Had to haul them immediately, on account of dogfish being so numerous. We got 50 mackerel,—20 salable, and 30 eaten all except heads; price, 25 cents each. This was done for several nights, with the same results. On September 1 started hand-line fishing on grounds located from Eastern Point, Gloucester, to Newburyport, about 5 to 10 miles off shore. Have been on the grounds the

past seven days, and each day after catching a few food fish, dogfish have appeared; and after making two or three berths of from 1 to 2 miles each we were obliged to leave the fishing grounds. (Capt. Wm. P. Brinnick, Boston, sloop "Jennie Maud," 3 to 4 men.)

We fish with trawls in the spring of the year until dogfish make their appearance; then we go south and fish for mackerel with nets. Dogfish are very numerous when the mackerel appear, and it is hard work to keep clear from them. They follow the fish along the shore, and are a pest from May until November, and sometimes later. The more mackerel, the more dogfish. They are so plenty in Massachusetts Bay after July 1 that we abandon netting and go sword-fishing until about September; then we go hand lining or trawling. Last spring one night off New York we lost 10 nets, valued at \$10 each, besides the fish they contained. We had taken from part of our nets 1,800 fish at 40 cents each, when dogfish struck; and we lost 10 nets and all the fish in the remaining net, valued at \$2,000 to \$4,000. (Capt. Fred Wolfe, Boston, "Priscilla," 8 to 12 men.)

We have not been bothered so much in the channel this summer as previous years, and we have caught a great many more fish. We have had to sell them cheaper, although we have made as much money. When we strike dogfish they ruin our gear and prevent us from getting a trip. In September, 1905, we made 2 sets, and got a large quantity of dogfish, and did not get 1,000 pounds of food fish; the 3 previous sets, in the absence of dogfish, we got 8,000 pounds of food fish each set. (John Thompson, Boston, schooner "Mary Edith," 14 men.)

Dogfish have been so plentiful for several years we cannot set any mackerel nets in falls as we used to, as dogfish chew the fish and gear all to pieces, and trawls about the same. (J. W. Sears, Provincetown.)

I think it would be the best thing that could happen to the fishermen, and to the public at large, making it possible to catch fish that it is now impossible to catch on account of dogfish. (Joseph Hobert, Provincetown, "Vesta," 4 men.)

I have been in the business 20 years, and when I first went, the dogfish would come about June 1 and go north in Massachusetts Bay, and be through by July 15. They would come back about September 1, and October 1 they would be gone by. Now they come May 15 and stay till November 1, without going away. When we are engaged in trawling, from November 1 to May 1, the dogfish are not on the coast. (John K. Cobb, Provincetown, schooner "Betsey Ross.")

We arrived at Boston to-day, Nov. 3, 1903, from fishing off Highland Light, Cape Cod. Small dogfish were very plenty there, and bothersome. We would have had 25,000 or 50,000 more pounds of fish, if dogfish were not there. During this summer we have lost by dogfish, in two trips alone, 50 tubs of trawls, valued at \$300. (Antonio K. Sousa, Provincetown, schooner "Philip P. Manto.")

It is almost impossible to fish with nets in Barnstable Bay now. The main damage is that where they have been we cannot catch any other fish. (Alfred A. Mayo, Provincetown, "Iris.")

Dogfish have driven many of our boat fishermen out of business by the destruction they have made, causing much loss of time and labor.

Used to save livers when they were in good demand for oil, but of late years they have not been worth marketing, unless encouragement is given by adding bounty. (William Pierce, Salisbury, dory, 1 man.)

Believe annual damage to trawls and hand lines will average from one-half to three-quarters of actual value. Have seen large quantities of hake and other good food fish driven upon beach by schools of dogfish. Market fish caught on trawls often entirely destroyed by dogfish, which are also found on trawls in large numbers. (H. F. Woodward, Salisbury, dory, 1 man.)

Dogfish cause great destruction to trawl gear; also responsible for large loss of bait and food fish. Have found may large cod and other food fish, which would weigh from 50 to 70 pounds, entirely eaten by dogfish, leaving only head and backbone hanging to hook. Set trawls with 900 hooks, and on hauling counted 700 dogfish, 2 hake, 1 cod. (Wallace Kenney, Beverly, sloop "Governor Cleaves," 2 men.)

Twenty years ago there were about 150 sail of small fishing boats belonging to this port; in the past year there were less than 50. A great deal of this decrease is directly responsible to the dogfish pest, which has practically driven two-thirds of our fleet out of business. This seems to me to be an unanswerable argument in favor of a bill to protect this industry, by paying a small bounty towards the wiping out of this nuisance. (Charles S. Currier, Newburyport, dory.)

Used to make good year's work fishing. Now in spring of year, when dogfish school about here, have to knock right off trying to fish, as they will destroy all food fish caught, and cause great damage, if not total loss, to all fishing gear put in water. Have hauled trawls finding nothing but head or backbone left of codfish which would weigh, if whole, from 60 to 70 pounds each; others with large bites taken out, entirely destroying market value. If fishermen were encouraged to make war on them by a small bounty, think everybody would benefit greatly by their decrease. (George M. Souther, Newburyport, dory.)

Dogfish will bite holes in a gill net about 4 or 5 inches square; also on trawls bite off the gangings and completely destroy same, taking bait and hook, leaving nothing but running line. We lose about from one-third to one-half of our trawl gear every year in this manner. If a bounty is passed, will try to have satisfaction on them for losses sustained. They have driven about two-thirds of our former boat fishermen out of the business entirely. (A. P. Hilton, Newburyport, gasoline boat, 2 men.)

Dogfish annually cause a heavy loss to small-boat fishermen. Trawls set over night are often found stripped of all marketable fish, besides being wrenched apart and snarled up so as to cause often total loss of material. After dogfish make their appearance many fishermen have to lay idle a long time, or go into some other industry to make a living. (Clarence C. Lunt, Newburyport, gasoline boat, 2 men.)

Mine is the same story as that of everybody else around here. Dogfish are a great nuisance, and if they could be driven off shore or destroyed, believe it would be of lasting benefit not only to fishermen but to general public. When dogfish strike round here a great many of the boat fishermen, after suffering their first losses, haul their trawls

and go ashore to loaf, causing great loss of time, and making fishing pretty poor business to get living at. Fishing fleet of this port reduced over two-thirds inside of twenty years. (George Thurlow, Newburyport, dory.)

Have been fishing from here for many years, and have seen fleet of this port decrease in number from about 150 to present number, below 50. Believe dogfish are directly responsible for driving many fishermen out of the business. Twenty years ago could get as high as \$1 to \$1.25 per bucket for dogfish livers; present worth about 25 cents. This price, unless small bounty is attached, does not pay fishermen to try to kill them off. (Jabez M. Eaton, Newburyport, dory, 2 men.)

Don't use anything but torches and dip nets to catch herring with, as I only fish short time each year. Have seen lots of damage done to nets and drag seines by dogfish getting inside and tearing their way out. Have seen lots of dogfish at night chasing schools of herring 2 or 3 miles up the river. (John E. Dolan, Ipswich, gasoline boat, 2 men.)

Used to save dogfish livers some years ago, but at present price not worth marketing. Large schools of dogfish come off here in spring, and see scattering ones up to late in fall. Follow herring up in river, and cause destruction to fishing nets, etc., besides destroying fish caught in nets and on trawls. (Samuel S. Small, Ipswich, Grape Island, gasoline boat.)

Have caught as high as 200 dogfish on hand lines in part of day, and lost all of bait. Have to lose much time in fishing by changing from one spot to another, on account of large schools of dogfish. When fishing for herring in river often see dogfish up 2 or 3 miles from mouth, after schools of herring. Many herring caught in nets destroyed so as to be unmarketable. (Edward Kent, Ipswich, dory.)

In using drag seine or set nets often have them damaged by dogfish, besides having to throw away many fish which were bitten by dogfish so as to destroy market value. Don't think annual loss to apparatus (\$50) is any over-estimated, as some years it will cost a good deal more than that amount to repair gear alone, not reckoning time lost in fishing. (John E. Haynes, Ipswich, gasoline boat.)

I fish mostly with crew of other boat, but occasionally set few nets for myself. Have often seen dogfish up in the river 2 or 3 miles. Believe they chase and scare the herring and bait fish, so as to make them a great deal harder to catch by fishermen. Often find herring partially eaten after being caught in nets. (Herbert T. McKenney, Ipswich, gasoline boat.)

Only fish for herring in fall of year, mostly in the river and vicinity. Dogfish often seen chasing schools of herring, making it harder for fishermen. In fishing with drift or set nets, find large numbers of herring caught, so badly eaten as to destroy them for market. (J. F. Claxton, Ipswich, gasoline boat.)

In replying to the foregoing questions, I have answered as truthfully as possible, and there are some questions asked which are very hard to answer. I have seen \$300 worth of trawls destroyed in one day by dogfish; and I have no hesitation in saying that unless the fishermen are paid for destroying them, dogfish will be so numerous

in Massachusetts waters that it will be impossible to obtain any food fish during the summer months. If we were paid for destroying them, when we get them on our trawls we could kill them by cutting off tail. Now we merely shake them off as quickly as possible, so we can get our trawls set again. (Valentine Neil, East Boston, schooner "Elmer E. Gray.")

Dogfish are so plentiful on the coast and in the bays that it is impossible to fish there between the months of May and November, and we have to go to some of the off-shore banks, such as Georges and Browns banks. If there was a bounty on dogfish (enough to make it an object to catch them), it would open a new industry for the fishermen, and would give hundreds of men and boats employment during the summer season without going to the banks, and in a few years would materially increase the supply of edible and bait fish. (E. J. Cunningham, Boston, "Stranger.")

On one trip this summer we lost \$200 worth of gear, owing to the dogfish. (T. W. McComiskey, Boston, schooner "Catherine D. Burke.")

If a bounty was placed on dogfish, I fear that it would be harder to get crews to fish for marketable fish, as the bounty would start the men for dogfish. (Antonio P. Goulart, Boston, schooner "Walter P. Goulart.")

I think if bounty went on dogfish it would make them scarce, and save labor for men and increase wages; and, more, it would give the men courage to destroy them. (Larance Norris, Boston, "Mary A. Whalen.")

My opinion in regard to the dogfish question is this: they are both a benefit and an injury to the fisherman. Where they are a benefit is this: they act as a scavenger, and eat up the gurry when you are dressing the fish, which, if they did not, would sink to the bottom and rot and drive the fish away. They destroy the trawls, which are replaced by new, which is really a benefit to fishermen. They are in these waters during the summer months, when there is an over-supply of fish; and if the dogfish destroyed more than they do, the fishermen would get more for what fish they brought in, and the market would not be glutted as it is now, with the fleet of vessels that is now fishing. I think that the dogfish are more of a benefit than an injury to the fishermen at the present time. (H. Daly, Boston, schooner "Harmony.")

That the damage is not confined to the Massachusetts fishing interests is made plain by Professor Prince's statement: —

The direct harm that a plague of dogfish can do is well-nigh incredible. Thus in 1882 the pack of cured herring in the Shetland Isles was 134,000 barrels, whereas in 1888, owing to the presence of dogfish, the total quantity fell to 99,000 barrels, and in 1889 even lower, *i.e.*, not more than 47,000 barrels, or only about one-third of the pack two years before, and representing therefore an enormous total loss.

Many similar cases could be instanced; but the facts as they exist to-

day in Canada are startling enough. The statement by Mr. Copp, M.P., in the House of Commons, Ottawa, on October 28 last, sufficiently indicates the grave nature of the matter. "The dogfish have become a serious menace to our fishermen in Nova Scotia," he said. "If the problem is not dealt with in some way it is going to seriously affect the fishing industries of the Dominion. . . ." The "Halifax Herald" of October 3 shows how the dogfish is helping to destroy the industry in Nova Scotia. This newspaper tells of "half a million shortage in our western Nova Scotia fisheries." It is estimated that west of Halifax (that is, in the counties of Lunenburg, Shelburne, Queen's, Yarmouth and Digby) the fishery catch is \$400,000 to \$600,000 below the average year.

A recent newspaper notice once more expresses this feeling of alarm: "Every week brings reports from widely different points about the trouble by dogfish, which are more formidable pests by sea than the potato bug is by land. Therefore some people contend that the government should take the matter up, and do something to exterminate the invading swarms of dogfish, or make them scarcer."

Opinions as to the best method of dealing with the dogfish nuisance upon the Atlantic coast appeared to be so diverse that much difficulty arose in deciding how best the government could aid in abating the plague. Professor Prince treated the whole subject in a special report last year, and summarized the many schemes, which had been urged upon the department's attention:—

The Fishery Commission in Gloucester County, N. B., which specially inquired into the matter along the south shore of the Bay des Chaleurs, found that the fishermen generally favored a government bounty, and the commissioners in consequence recommended the payment of an adequate bounty to encourage the fishermen to exterminate the dogfish. The Commissioner of Fisheries himself favored departmental action through its officers as the most direct method of coping with the evil, as it appeared that a large bounty could not be offered, and the fishermen could not be expected to forsake their ordinary remunerative occupations and sufficiently exert themselves to capture the schools of dogfish. A further scheme was the organization of reduction works at the certain central points, where valuable products could be manufactured from fish waste, dogfish, etc. The manufacture of oil and fertilizers from dogfish, fish offal, etc., it was claimed would make possible adequate payment to the fishermen for the dogfish captured and the fish offal brought to the reduction works, and the extensive and rapid destruction of the schools of dogfish would be actively stimulated.

Hence a large building is being erected at Canso, as the first of these government-aided reduction works; and the plant, manufactured by the American Process Company of New York, is being installed

so that the utilization of dogfish and fish offal will be carried out next season.

Two other plants have been obtained by the government, and reduction works will be erected this year at some point north of Canso and at some point in western Nova Scotia. They will probably be run under departmental auspices, unless it appears more advantageous to have them operated under some mutual arrangement between the department and the local fishing firms. Whatever will most rapidly and effectively secure the extermination of the dogfish and their conversion into marketable products will, it need hardly be said, meet the general approval of the fishing population, who have suffered such serious losses in recent seasons from the dogfish plague.

Their use as food has long been recognized in Norway, the Channel Islands, and in the Hebrides and northern islands of Scotland; and, indeed, in Aberdeen, Scotland, dogfish prepared in various more or less appetizing ways have found a ready market, and some such scheme is being tried by several parties in the maritime provinces. Recently three or four enterprising lobster packers in Prince County, Prince Edward Island, Cape Breton and Richmond counties, O. B., and in Shelburne and Digby counties, western Nova Scotia, have most successfully put up canned dogfish, which have been pronounced in that preserved form as "superior to salmon."

In most markets a prejudice exists against dogfish and all such members of the shark tribe, especially amongst our own population, who have such a superabundance of the most excellent kinds of food fishes available in the lakes, rivers and seas of the Dominion. No means, however, of creating a demand for dogfish products should be neglected, in view of the fact that, unless extensive measures be taken, and the wholesale extermination of dogfish stimulated, this greatest and worst enemy of the fishermen may continue to inflict loss and destruction along our Atlantic shores.

From the Atlantic coast and the Shoals of Northumberland the complaints are general of the apparently increasing quantities of these fish, and of their interference with the line and net fisheries,—the line fishing by taking the bait, and the net fishing by destroying the fish in the nets and the nets also.

The ravages of these scavengers of the sea have been written about so frequently to your department during the past few seasons, and by those interested, that it is needless for me to refer at any length to this important subject. The newspapers of the maritime provinces, with those of the New England States, have been deluged with correspondence on this very absorbing topic for several years past. What action to take in dealing with these sea wolves is a subject of serious concern for the whole North Atlantic seaboard, and it is earnestly hoped that vigorous steps will be taken which will lessen the ravages of this voracious fish, or that the schools of dogfish will make one of those surprising and mysterious movements with which they are credited, and disappear from our coasts with the same rapidity that they invaded them.

Speaking about the mackerel industry, I may say that the waters of the gulf this season contained the greatest abundance of mackerel

ever witnessed as yet; but the general catch has been very limited, owing to the presence of dogfish on the grounds. Literally, mackerel were routed, as it were, from the shore, and had made an entire abandonment by the first of October. Although one of the greatest impediments to successful fishing of all kinds, the dogfish, looked upon with horror and disgust, bids fair to become, when largely introduced, one of the greatest and most remunerative industries in Canada. Foreign nations have already made a test of the dogfish, and pronounced it a favorite and substantial food fish, with very nourishing elements. On October 20 Mr. Geo. LeBrun packed a case of dogfish. I was in his kitchen on that day while he was preparing the fish, and he had some cooked on the table, which he offered me. I was much surprised at the taste, and found it very excellent, and not in the least oily, as anticipated. The flesh was white and soft, and very palatable. It must be borne in mind that the flesh of the dogfish contains no oil whatever, as none can be found or even tasted whenever cooked; hence the oil must be attributed to the skin.

The greatest drawback of late years to the successful prosecution of the fisheries is the dogfish pest. What is to be done to exterminate them must engage the attention of the department. No doubt the home of this species of the shark family is the southern waters. Fifty years ago they were as numerous and destructive to other fish in the coastal waters of the maritime provinces as they are to-day. At that time large numbers were captured by the fishermen. A gallon of dogfish oil was worth then from forty to fifty cents; to-day less than half of that sum could be realized. Not only were those fish captured in the fifties and early sixties for their oil, but the flesh was fed to hogs, and sometimes dried, ground and fed to horses and cattle. They frequented our coastal waters during the summer months for about twelve years, when they disappeared until ten years ago; since then they appear to increase in numbers year by year. They make their first appearance each summer in the month of June, or about the time the mackerel make their appearance from the southern waters. The dogfish remain all summer. In the autumn they disappear, or about the time the mackerel schools begin journeying to their southern haunts. Like mackerel, they cannot exist in our waters in winter.

Not only are the dogfish a hindrance to the successful prosecution of the fisheries on account of their destruction of the gill nets, and devouring the fish caught in nets and on trawls, but they frighten the food fish from our coast. Early in June I visited some of the cod banks off Sydney harbor. Equipped with cod gear, I fished on these banks, and experienced no difficulty in catching cod. An occasional dogfish was hooked, but they were not numerous on these banks at that time. In August I again visited the same banks, and no sooner did the baited hook reach near the bottom than a dogfish would bite. There were no codfish on the banks, evidently driven away by the voracious dogfish. A number of the mother fish caught were opened, and young taken out. From 3 to 5 young, 6 or 8 inches long, proved to be very much alive. They would squirm about the deck of the steamer as lively as the full-grown fish. Each of the young had a sack on one side near the neck.

The dogfish multiply very rapidly, and unless fished, or some means adopted to exterminate them, they will ultimately ruin our commercial fisheries. There is no doubt dogfish are the direct cause of the failure in recent years of the midsummer herring fishery. This excellent food fish, before dogfish made their appearance on our coast, came into our bays and harbors in immense numbers. They were captured by fishermen and farmers by means of gill nets. Of late years, or since dogfish made their appearance, these valuable fish have disappeared from our coast. A bounty offered by the government of 20 cents per gallon for their oil would induce their capture by fishermen.

On the European shores of the Atlantic, too, similar conditions obtain. A writer in the "London Mail" says:—

The cry has gone up, "The dogs are upon us!" This is no new cry. From Plymouth to the Lizard, from Newlyn to St. Ives, all along the best fishing grounds of the west there comes this moan when the leaf falls,—"The dogs are upon us!" And season after season the moan increases in anguish, until the cry is loud and bitter, as it is to-day, when our deep-sea fishers return with nets torn, and tons of dogfish upon their lines, for which there is no paying market.

Our fishers are so helpless, which makes the moan pathetic when first heard, and then tragic and more tragic when winter comes, and with winter, want and the bitter cry of women and little children. And this happens year by year now, conceal it how we may, when the "gluttons of the sea" come in countless numbers, hunting, in close formation, pilchard and herring, and then swooping upon everything that swims. There is no mistake about numbers in the packs, for the fishers say they are so thick that one "may walk on them;" and in home waters there is nothing to be compared to a charge of dogfish for magnificent destruction. It is not war, but slaughter of timid, dainty clupea, which dogfish devour until they vomit, and then continue their almost endless feast. The fishermen speak of the advent of these gluttons as a "plague," and the plague has increased, and is increasing, in territorial waters.

The story is simple. Dogfish hang upon the outskirts of immense shoals of pilchards, driving them towards the English Channel and into the sheltered bays of the Cornish coast, wherein they are captured in seines and driftnets. The more venturesome of our drifters meet them early in the season in the deep waters of the Channel, but the evil days come when the keen hunters approach the shore and prey upon the fish, now feeding with a delicious sense of security in sheltered bights and bays. Our fishermen know the fact all too soon when their nets hang in ribbons, and the captured fish are devoured already, or remain in the mesh in all stages of mutilation. Formerly this "plague" was recurrent, and old men speak of long intervals between one plague and another; but now the dogs have multiplied out of all proportion, grown bolder, and hang on to their prey even when the men are drawing their nets, or what is left of them.

The cry, "The dogfish are upon us!" terrifies fishers and paralyzes

industry for a season, for men may lose in nets alone in one night the profits of a month's strenuous labor. Last year 300 drift boats, carrying over 1,000 hands, were kept idle in the little ports of Looe, Polperro and Mevagissey alone, the men preferring to earn nothing in the very midst of their season's harvest, to the risk of having their nets cut to pieces by dogfish. At Plymouth, boats were idle and soup kitchens opened; and at Mousehole, Newlyn and St. Ives, distress was great. It is the fact that packs of dogfish effectually blockaded the fishing ports, and continued to do so until pilehards disappeared and the herring fishing was spoilt. The dread experiences of last year have so far been repeated. Swarms of dogfish are reported everywhere. The drifters venturing out hug the coast at the risk of having their nets torn by the rocks, and then only fish half time, through fear of the dogs scenting them and spoiling their gear.

There are several varieties of dogfish, all having the same gluttonous and destructive instincts; but the picked dog is the most dreaded, being armed under its two dorsal fins with sharp curved spines, with which it rips nets hanging in the sea with the ease of a mower cutting grass with a scythe. The mischief is not confined to the drifters, but extends to long liners, who fish abundantly in these waters for conger and skate. The dogs carry off their bait, sometimes bite off the hooks and go free, and when caught are of but little commercial value. A Looe fisherman recently reported hauling 1 conger and 500 dogfish on his "bolter;" so the men look serious when spoken to, and ask anxiously if some remedy may be found.

DOMINANT SPECIES.

That certain species become dominant, and increase so rapidly and over such a wide range of territory as to greatly diminish the number of other species of similar habitat, is a well-known biological fact, which requires no further proof. The most immediate examples are the English sparrow, the gypsy and brown-tail moths, etc. The facts indicate that the dogfish as a species is actually increasing in numbers, and appears to be likely to become such a dominant species; and until some natural or artificial check upon its increase arises, the damage done to the wealth-producing capacity of the North Atlantic Ocean will extend rather than lessen.

CAUSES OF INCREASING NUMBERS OF DOGFISH.

The causes of these increased numbers of dogfish are difficult to ascertain. There appears no very obvious diminution in the numbers of the enemies of the dogfish. They are not known to be subject to any special epidemics, as are many other fish, *e.g.*, the salmon family, menhaden, etc., or to be liable to

any such cataclysm as destroyed such incredible numbers of tile fish; so that one is almost forced to seek the cause in the effect of human agency upon the balance of fish life. For almost three hundred years the North Atlantic has been scoured for marketable fish. The breeding fish and the young of all sizes have been marketed or wasted with almost unspeakable prodigality. Our attention has in the main been devoted to the more readily available fish, such as the cod and herring family, mackerel, etc., while the dogfish, sharks, skates and rays have been gotten rid of with the least exertion or expense. Their capture has been even avoided to the utmost possible extent. It is a general practice to seek new fishing grounds when the dogfish strike. Thus the dogfish has been practically immune from capture. Other species have in many cases decreased in numbers. In no other case which the writer now recalls has there been a marked and certain increase. The dogfish, thus freed from a part of the competition, and so much better able to secure food, has multiplied in all sections of its range. The fishermen are largely responsible for this, though chiefly on account of the absence of knowledge and experience with such problems. Professor Prince, in his able report upon the dogfish plague in Canada, says on this point:—

If the parent dogfish, with their unborn brood of young, ready to emerge into the sea, were brought ashore, it would be one of the most effective steps possible to reduce their numbers. Yet it rarely, if ever, occurs to a fisherman to do this. Instead of that, the young are freed, and the parent fish, mutilated in some way, are as a rule also replaced in the water, though mutilation is of little moment to a dogfish. They are so hardy that even after the tail is cut off or the head badly injured they will swim off most actively. A shark, after being most cruelly injured, has been known to immediately return to the bait and be captured a second time. Owing to the hardy and well-protected character of the young, the offspring of a single female, though few in number, may approach, as already stated, the progeny of the cod or salmon, which produce eggs by thousands or even by millions each year. Fishermen hold that dogfish breed all the year round, but this is not so, and the fall and winter months appear to be the principal time. . . .

Further, fishermen and others should be discouraged in the common practice of liberating young dogfish in the ocean, and the destruction of the parent fish with their broods of contained young should be enjoined. If, as is stated, the dogfish taken in December are for the most part females, their capture at that time is of immense importance.

The destruction of breeding female fish has been abundantly shown to be a direct means of reducing the supply of fish in the future. The increase of dogfish in recent years has been accounted for by their less extensive capture for oil purposes. The low price of fish oil has discouraged the annual destruction of dogfish, formerly carried on systematically. But that suggestion will not account fully for the increase.

VARIOUS METHODS WHICH HAVE BEEN SUGGESTED FOR CHECKING THE INCURSIONS OF DOGFISH.

Many suggestions looking to increased killing of dogfish have been made by numerous individuals more or less competent to judge of the merits of various plans. These have been earlier summarized in Professor Prince's report:—

1. Liberate alive some hundreds of dogfish having securely fastened outside their bodies (by means of hooks, wires, etc.) glittering and gaudy streamers or jingling chains or bells, calculated to terrify and frighten away the schools of dogfish, on the old principle of setting at liberty a rat with a bell hung round its neck.

2. Inoculate a number of dogfish with some fatal or contagious disease, thus securing the infection and death of all the schools of dogfish which may hover near, on the principle adopted in reducing the pest of rabbits in Australia some years ago.

3. Dynamite the great schools of dogfish when they appear.

4. Employ the government cruisers and their men in capturing these pests, or let the government employ special vessels for the purpose, until the plague is reduced.

5. Pay a bounty of 1 cent for every five tails of dogfish (\$2 per 1,000) brought to a fishing officer, and, after being officially recorded, destroyed by such officer. Many fishermen have declared that they get 1,000 dogfish in a single day not infrequently; yet it is asserted that even \$2.50 per 1,000 would not pay.

6. Pay a bounty on the basis of the weight of the dogfish captured, say so much per 100 pounds. Some parties claim that \$2 to \$3 per ton or $\frac{1}{2}$ cent per fish would pay the fishermen; while others say that, as dogfish average a weight of 4 pounds, such a bounty of 1 cent each fish would pay. Thus the suggested rates range from 10 or 15 cents per 100 pounds to 25 cents per 200 pounds.

7. Pay a bounty on the total yield of oil, a fixed rate on each gallon of oil produced by a factory being guaranteed to any firm or company carrying on reduction works.

8. Use long seines of strong cord, 1,000 yards or more in length, under departmental direction, and surround the schools, as is done with the schools of sharks in India.

If, as seems clear, the commercial products yielded by dogfish bring such low returns in the market that it will not pay oil and fertilizer factories to utilize them, and cannot therefore pay the fishermen to fish for them or even to save them when caught accidentally, then a

bounty paid by the government seems to be necessary. The livers of dogfish bring to the fishermen 25 cents per pail, and on an average perhaps at least 50 dogfish are required to make a pail of livers; and the loss of hooks, bait and time have all to be included; hence only the encouragement of a bounty will ensure the energetic and continuous destruction of these fish. Certainly the suggestions numbered 1, 2 and 3 would probably harm the schools of valuable fishes as much as the detested dogfish, while the employment of a few vessels or government cruisers would not suffice to deal with so general a pest as the dogfish on our shores. Reliance can be placed only on the co-operation of the fishermen all along the coast, stimulated by a bounty fairly and effectively distributed on a workable basis; unless, indeed, the dogfish in the meantime take the course they have so commonly taken in former times and on other coasts, and disappear as suddenly as their hordes originally have appeared. The problem would then solve itself.

DEVELOPMENT OF AN ECONOMIC DEMAND FOR DOGFISH.

Of all the suggestions made, the one which offers most advantageous features to all parties concerned, — to the public, which now pays a higher price for fish than would be otherwise necessary; to the fishermen, who now lose much time and suffer annoyance and damage from the voracity of the dogfish; to the capitalists, who find the interest on their investments cut by the loss of gear and time, — is the development of an economic demand for dogfish. A bounty of a fixed sum for each dogfish destroyed, paid either directly to the fishermen, or, what would practically amount to the same thing, a subsidy or “protection” (protective tariff) to every industry based upon economic utilization of the dogfish or dogfish products, such as, for example, the utilization of the cartilaginous skeleton and the connective tissue of the skin in making glue (it has been ascertained that the disagreeable oily odor can be completely removed by treatment with live steam), and the preparation of the remainder of the carcass as a poultry food. If the sterilization is made by live steam, the flavor of the flesh will be modified so that the proper amounts can be fed to laying hens without causing a disagreeable or fishy taste to the eggs; while as a food for growing chickens and ducks it should be one of the best and cheapest sources of protein, — the most necessary and the most expensive element in the ration. Obviously for such a purpose only perfectly fresh dogfish should be utilized, for poultry as well as human beings may suffer from ptomaine poisoning. Old or

inferior quality may be profitably utilized in the manufacture of fertilizer. The liver and eggs should be removed, and the oil extracted separately from the body meat. Mr. Ellison of Cleveland, O., states that according to his observations 15,000 pounds of dogfish yielded as follows: the livers weighed 2,274 pounds, which furnished 1,010 pounds of oil, or about 44 per cent.; the bodies, weighing 12,726 pounds, furnished 605 pounds of oil, less than 5 per cent., and 2,573 pounds of fertilizer, or about 20 per cent. (He does not, to our knowledge, state the per cent. of water in this fertilizer, or the results of chemical analysis.)

The observations of Mr. A. B. Cox, manager of the dogfish reduction works at Canso, N. S., indicate that on October 3 the dogfish livers contained a far larger percentage of oil than Mr. Ellison found. Mr. Cox's figures indicate a yield of practically 75 per cent. of oil from the livers and 5 per cent. from the flesh. It is probable that these differences in yield of oil are due to the greater freshness of Mr. Cox's material, as it is well known that dogfish, whales, etc., lose a considerable percentage of oil unless the rendering process immediately follows death.

THE DOGFISH REDUCTION WORKS AT CANSO, N. S.

Oct. 2 and 3, 1905, we personally inspected at Canso the first of the dogfish reduction works to be put into operation under the auspices of the Department of Marine and Fisheries of Canada.

This establishment began operations about September 15, and was designed to reduce about 10 tons of dogfish or fish offal daily. The machinery used was furnished by the American Process Company, and is of the type generally used in the "menhaden factories" in this country, and with certain modifications in the "whale factories" of Newfoundland. At the time of beginning operations Mr. Cox was obliged to make a week's trip among the fishermen, to explain the plan and to induce them to bring in the dogfish caught. As soon as shipments began to come in from points outside of Canso, *e.g.*, Arichat, Petit du Grat, etc., the Canso fishermen began to save their dogfish. The result was a great surprise to all. It had



1. DOGFISH REDUCTION WORKS AT CANSO, N. S.



2. CATCHING DOGFISH, CANSO, N. S.



3. ARRIVAL OF DOGFISH CATCH.



4. LANDING DOGFISH.



5. THIRTY-TWO TONS OF DOGFISH ON THE WHARF.



6. REMOVING LIVERS.



7. LOADING THE ELEVATOR.

The small white spheres on the cleared space on the wharf are dogfish eggs



8. DRYING DOGFISH, FOURCHIE, C. B.

not been realized how many dogfish had been hooked and thrown overboard again. One of the fishermen had 2 trawls, set with 1,500 hooks on each. He tended the first trawl as soon as the second trawl was set, and "nearly every hook had a dogfish." On October 2, in spite of the fact that notice had been sent out the two days previous that, on account of the overwhelming quantities which came in, no dogfish would be received until October 4, we saw 8 loads from steamer, small schooners and dories brought and landed upon the dock. Three dories brought 7 tons, three small schooners brought 17 tons, and one small steamer brought 8 tons, — a total of 32 tons. The price paid for the fish delivered on the dock was at that time \$6 per ton if "livered," and \$5 per ton if "unlivered." These prices included the livers. Even at \$4 per ton the dogfish would have been a bonanza for the fishermen. Two men in a dory could easily make from \$7 to \$8 a day per man, catching dogfish within one mile of their own homes.

Since our visit we learn that many improvements in the process have been developed, and several new mechanical devices are to be instituted. The results of treating the livers separately from the bodies have been much more satisfactory. The drying process has been much accelerated, and has resulted in a quality of fertilizer which more readily becomes available for plant food in the soil.

There is a probability that certain special parts may be utilized for particular purposes, *e.g.*, the fresh eggs may be conserved in such a manner as to be used for some of the purposes for which the yolks of hen's eggs are now demanded. The embryo dogfish ("pups") may be found to be satisfactory bait, and thus be worth handling separately. Further investigation may disclose internal organs which can be converted into gelatin, after the manner of the "sounds" of sturgeon, hake, weakfish, etc. But above all, the flesh and the offal are converted into a valuable fertilizer, which will be of great assistance in increasing the crops of potatoes, fruits and garden truck, by furnishing a type of fertilizer much needed, on account of the short season, for pushing the crops to the rapid maturity necessary.

We learn that the plant has been inspected and has received the approval of the officials of the Department of Marine and

Fisheries. The general sentiment among the fishermen is favorable to the project. The chief objections are found among the opponents of the present government, who claim to see therein a shrewd political move. Be that as it may, the project promises the destruction of a vast number of dogfish, thereby benefiting the public and the fishermen through the improvement of the bait and food fisheries. It furnishes a market for what was previously a "waste product" of the fisheries, or, even worse, a waste product which was positively injurious, unless removed at a considerable expense. In addition, it is a direct benefit to the farmers and to all citizens and land owners, since it furnishes a valuable fertilizer readily available at a low price. It is therefore not strange that such efficient action should have strengthened the political party which made such a project possible.

SIMILAR PLANTS ELSEWHERE.

Since our visit a second and similar plant has been put into active operation at Shippegan, N. B., on Chaleurs Bay, and contracts for a third plant have been placed.

A Honolulu correspondent of the "New York Tribune" recently wrote that:—

A company has been formed to hunt sharks on an extensive scale, and as a commercial enterprise. Several schooners have been purchased and fitted out with the necessary paraphernalia and appliances for capturing these monsters of the deep.

The purpose of shark hunting is two-fold. One object is to obtain oil from them, the remainder of the shark to be used in the manufacture of fertilizer for the sugar plantations of the islands. Shiploads of fish offal from the Alaska salmon canneries are brought here every year to be made into fertilizer for sugar lands, and it is believed that the bodies of sharks will supply the same material, and at less cost.

The oil is to be sent to China, where there is a great market for it. Some shark oil has been sent to China from there for many years, but the greatest drawback to the trade was that until now there was no method whereby the strong odor of the shark could be eliminated from the oil. A successful process has at last been discovered, by the treatment of the oil with live steam, and a demand has been created for this product which is greater than can at present be supplied.

In the fertilizer works it is estimated that thirty tons of shark a day can be utilized, and that this will employ the services of at least three schooners and their crews.

The waters of these islands teem with sharks, and shark hunting is a pastime that appeals to many.

DOGFISH AS FOOD.

There is another phase, and perhaps the most important asset in the dogfish problem, viz., its availability as a cheap and wholesome food. From personal experience we can give testimony to its satisfactory taste, lack of odor or "strength," and its consistency when cooked or canned. It has, when canned, a distinctly obvious lobster flavor, together with a certain salmon impression, so that from the taste it can best be compared to a mixture of canned lobster and canned salmon. When cut into steaks and fried, it closely resembles halibut. Its freedom from bone makes it especially safe as a food for children or for aged persons. There would appear to be unlimited possibilities for developing a business in specially prepared brands of food, wherein the dogfish may be combined with rice, potatoes, etc., making "canned fish balls, all ready to fry," etc., after the manner of "fish cheese" now being much used in Newfoundland and Nova Scotia. The inferior cuts of meat can be converted into a food for growing poultry, pigs, etc. Objection may be raised to the fact that fish food may tend to affect the taste of meat when marketed. This is true of other foods besides fish, but it can be obviated by the proper method of feeding. On the coast of Nova Scotia dogfish are dried and fed to horses. "One every three days brightens the coat."

Our English cousins are in advance of us in the exploitation of the dogfish as a valuable, cheap food. A writer in a London paper says:—

The dogfish is excellent eating and ridiculously cheap, and the remedy should be near. Make it worth our men's while to catch, and the species will enter on a struggle for existence. Last year the Cornish fisheries committee held an official inquiry at the principal fishing ports, when it was clearly shown that, after paying all costs, charges and expenses, fish sold at Billingsgate at 1½ d. per pound would pay the fishermen to catch in ordinary seasons. The Plymouth council engaged an expert cook to prepare dogfish for the table, with and without sauce, and the published results were excellent as to color, flavor and firmness under the slicer. No fish not "prime" could be better spoken of. Then it is nutritious and boneless, and so a very safe food for both young and aged.

The committee of inquiry concerned itself but incidentally with the dietetic qualities of the fish and its value as a national food asset. They

reported, however, on the terrible losses to our fishermen, threatening the extinction of an industry already too little remunerative; and, in a spirit of despair, suggested dynamite, and the establishment of factories, as in the United States and Canada, for utilizing the fish for its by-products — oils, albuminoids and glucose — and its residue for land fertilization. The Devon fisheries committee joined the Cornish, and there has been a conference at Plymouth; but little has come of it except the passing of a resolution calling upon the government to do something. Men are now fearful of casting their nets in the home waters until April next, when the "plague" should disappear, silently and mysteriously, in obedience to some law not yet ascertained by our marine biologists.

One suggestion, palliative at best, is the employment of small government steamers to drag the home waters with specially prepared wire nets, which the picked dog cannot destroy with its sharp "spurs," and so insure peaceful fishing to drifters in sheltered bights and bays; for our fishers will not hear of dynamite or any downward explosive on their fishery grounds.

The preservation of the fishing industry is in very truth a matter of national concern. Every village on our coast is a nursery for seamen for the royal navy, and rears a population next to impossible to produce under the totally different conditions of atmosphere and employment in towns. The hereditary instincts of seamen are the slow growth of centuries, and discovery will come too late, if once our fishers are compelled to adopt other occupations, — a contingency which looms nearer every season of failure and disaster. At present our navy and naval reserve are recruited largely from the fisher class.

Cannot the dreaded dogfish, the glutton of the sea, become a welcome guest, and, instead of being treated as a waste product of nature, be converted into cheap food for the masses? A brisk demand for it as an edible would dispel the gathered and still gathering gloom. Our fishermen would catch it with special net and hook, if only it could be sold at fairly remunerative prices. At present the dogfish finds its way principally to fried-fish shops; but if once known for the excellent table fish it is, for the low price at which it can be delivered in London and great industrial centers, it would be welcomed by thousands to whom strict economy in living is a first necessity. At Brighton and the Isle of Wight the fish is well known, and it is sold in many places under various names, at prices which would make our fishermen's eyes glisten. The name "dogfish" is said to be against the fish for the tables of persons accustomed to something more euphonious for their menus; but if it became the vogue, the fishmonger might be relied on to dissipate prejudice on that score.

From now until April, at least, an unlimited supply of dogfish can be sent to market from the west, at rates which should be of the first importance to the necessitous, to the unemployed, and to all persons charged with the administration of charitable relief. Its consumption would benefit our fishermen, and make them anxious to catch instead of avoiding the dogfish, so thinning its ranks. It would also add, on the average, two remunerative working months to each year.

OTHER COMMERCIAL POSSIBILITIES.

It is of interest to note that many sea-food canning factories were established in Japan to furnish supplies for the army. Canned dogfish is one of the staples. With the close of the war an outlet must be found for the product of these canneries. Considerable dogfish is also packed in Canada for export to the Western Islands and to the West Indies.

It does not seem probable that in New England and the Middle Atlantic States any favorable market can be developed for dogfish as food; and no encouragement should be given to put dogfish on the market under the name of halibut or other staple fish, or under any misnomer whatever. The supply of staple fresh fish is at present abundant, adequate, and satisfactorily cheap in price. There are in Massachusetts few canneries where the fish might be utilized; though in the States to the south of us dogfish might be canned when oysters, etc., were not available for the canneries. In this section the demand rather points towards currying oil, poultry food and fertilizer; and the logical plan would appear to be the development of some economical method of making the catching and sale of both large and small dogfish sufficiently remunerative to induce the fishermen to bring in the dogfish along with the cod, haddock, pollock, mackerel and other valuable fish.

Some further commercial possibilities are referred to in the report of Mr. Paul M. Carpenter. Here Mr. Carpenter supplements his observations on board the fishing vessels and at hand-line fishing at Provincetown, by calling renewed attention to the report of Mr. Charles N. Stevenson on "The Utilization of the Skins of Aquatic Animals," annexed to the report of the United States Commissioner of Fish and Fisheries for the fiscal year ending June 30, 1902.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—On June 24, 1905, I was appointed an agent of the Massachusetts Commission on Fisheries and Game, for the purpose of investigating the food of certain deep-sea fishes, particularly of the dogfish, and to collect any information upon the damage done to the fisheries by dogfish or other predatory fish. I at once entered upon the discharge of my duties, establishing my headquarters at Provincetown. I have devoted my attention chiefly to the study of the dogfish and his

habits, this fish having of recent years become a serious menace to the fisheries of the Commonwealth.

The attention of the United States Fish Commission was first called to the rapid increase of dogfish in Atlantic waters in February, 1882, by Capt. J. W. Collins, then attached to the United States Commission on Fish and Fisheries at Washington, and later, until his lamented death, the accomplished chairman of the Massachusetts Commission on Fisheries and Game. In a letter to Prof. S. F. Baird, then United States Commissioner, Captain Collins wrote:—

In the "Cape Ann Advertiser" of Feb. 18, 1882, I find the following paragraph: "Immense schools of dogfish, extending as far as the eye can reach, have appeared off Portsmouth, an unusual sight in winter." Is it not possible that the presence of dogfish in such abundance in that vicinity, this winter, may have something to do with the scarcity of cod in Ipswich Bay? It is a fact well known to fishermen that dogfish in summer will drive the various species of bottom fish from the grounds, and it may be that they are quite as voracious and troublesome to the cod in winter as in warmer weather.

Again, two years later, Captain Collins called the attention of the government to this matter, in a letter dated July 7, 1884, in which he wrote:—

Capt. Joseph Smith of Gloucester, Mass., tells me that while off Wood Island, Me., in August, 1880, he observed what he supposed to be at first a moderate-sized school of mackerel, at the surface of the water. On closer inspection, however, he found that only a small number were mackerel, probably not exceeding half or three-quarters of a barrel, and these were completely surrounded by an immense school of dogfish. The body of dogfish was formed in such a manner as to enclose the mackerel on all sides and underneath, completely preventing their escape. Captain Smith had an opportunity of observing the mackerel closely, and says that many of them he noticed were bitten by the dogfish, some being deprived of their tails, and others having wounds on their sides. He is of opinion that every one of the mackerel was ultimately eaten by the dogfish. It is probable, he thinks, that at first a much larger body of mackerel was surrounded. The school of dogfish he estimated to contain at least enough for 100 barrels. Another school of dogfish, surrounding a small body of mackerel, was seen on the same day.

Annexed to the annual report of the United States Commissioner of Fish and Fisheries, for the fiscal year ended June 30, 1903, is a report by Mr. Barton W. Evermann, assistant in charge of the Division of Statistics and Methods of the Fisheries. In discussing the dogfish Mr. Evermann says:—

Dogfish appeared on the coast in and near Penobscot Bay in unwonted numbers in 1902, and committed great havoc among the deep-water fishes. They appeared earlier than usual, being found near Monhegan Island as early as the middle of May, and becoming quite plentiful all along the coast in June; but August appears to have been, as usual, the month of the greatest abundance. As illustrating their abundance, and the damage wrought by them to the shore fisheries, Mr. John N. Harri-man of Stockton Springs, who fishes a great deal in the lower Penobscot Bay, near Matineus, at Isle au Haut, etc., stated that he never knew dogfish so plentiful. They came into the bay early, about June 1, and remained until late in the season. A Seaport fisherman also caught dogfish just outside of Brigadier Island. Mr. Alvah G. Dorr of Bucksport, who fishes for haddock, cod, etc., near Gott's Island,

found dogfish troublesome about the last of June. Around Mount Desert Rock the large fleet of fishermen usually at work there were all driven from the fishing ground by the dogfish early in July, and had hardly begun again September 9. The dogfish not only seize the bait on trawls, but attack other fish that have been hooked. On August 9 Mr. Dorr set his usual trawl, 1 tub of 500 hooks, about 1 mile outside of Gott's Island, and secured at one haul 217 dogfish, 5 haddock and a good many heads of haddock, of which the rest had been eaten off by dogfish. On the same day another man fishing in that locality, with about the same number of hooks, caught in one haul 224 dogfish, 2 hake heads, and 3 skates. Mr. Dorr opened perhaps half a dozen dogfish, and found that nearly all were females, with living young within, about 8 fish to each mother, which would swim off on being thrown into the water. In the Penobscot River, near Sandy Point, a trawl set by Mr. Ernest A. Partridge of Stockton Springs, in 15 fathoms of water, took 50 dogfish in one day. Occasionally, but not very often, dogfish are caught in salmon weirs. The fishermen report 9 dogfish caught in weirs at Stockton Springs, 6 at Penobscot and 9 at Verona.

In the summer of 1904 the dogfish became unusually and remarkably troublesome to the fishermen of Cape Cod. Capt. Benjamin R. Kelley of Provincetown, a fisherman of much experience, found them far more plentiful in that vicinity than ever before. They made their appearance in large numbers, he says, about the middle of July. They were very large and voracious, and were so destructive of nets and gear that near the end of July many of the fishermen were obliged to take up their nets and trawls, dry them and store them away, in order to save them from destruction. Some of the larger vessels reported the loss of hundreds of dollars' worth of nets and trawls destroyed by dogfish. Before the close of the season it became impossible to keep a hook on the bottom for ground fishing, the dogfish not only destroying the fish on the trawls, but devouring the bait and destroying the gear. In the south channel, southeast of Noman's Land, these fish were especially numerous and troublesome, seriously reducing the value of these fishing grounds. Lobster men also reported much annoyance from the dogfish, which would enter the pots and consume the bait. Frequently 4 or 5 dogfish would be found in a single lobster pot. The mackerel, once so plentiful in Cape Cod Bay, in the season of 1904 were quite scarce, the scarcity being due, in the opinion of the fishermen, to the presence of the dogfish in so great numbers.

Upon examining the edible fish caught on the trawls, it was noticeable that, contrary to the reported habit, comparatively few presented the appearance of having been attacked by dogfish. From these facts stated, together with the additional fact that many of the dogfish caught appeared to be not fully grown, I concluded that the pugnacious nature of the dogfish does not develop until he approaches maturity. I found no trace of lobsters or shellfish in the stomachs, although the occasional presence of large deep-sea scallops on the trawls was evidence of an abundant supply of these shellfish at the depth reached by the trawls.

Although the month of August is the time of year in which the dogfish may usually be expected to be the most annoying, the reports from all the fishermen indicated a far less number than usual in the vicinity of Cape Cod. In numerous trips which I made to the Ledge and other fishing grounds within a day's sail of Provincetown,

experience indicated much less annoyance than usual to the fishermen from this cause. Reports were persistent of the presence of dogfish in great numbers off the coasts of Maine and Nova Scotia. This report, taken in connection with an unusual scarcity of mackerel in Cape Cod Bay during the past summer, was taken by fishermen as an indication that the mackerel had fled to the eastward, pursued by the dogfish.

In August I visited the United States biological station at Wood's Hole, and there learned that conditions similar to those at Cape Cod, relative to dogfish, prevailed at that point.

The fishermen of Provincetown were also perplexed and annoyed by an unusual scarcity of squid, which is commonly found in great numbers in the harbor, and which is used generally for bait. Many vessels were detained in port for a large part of the season by the difficulty of procuring this bait. Others used porgies or herring for bait, although squid is preferred. It is not impossible that some connection may be traced between the scarcity of dogfish and that of squid in the vicinity of Cape Cod, for it is certain that the dogfish is fond of the squid as food.¹ In the summer of 1902 an immense school of squid, pursued by dogfish, took refuge in the shallow parts of Provincetown harbor, and was left on the shore by the receding tide. So enormous was the number of these stranded squid that the board of health of the town found it necessary to employ a large number of men to remove the bodies, in the interest of the public health and comfort.

The report of the appearance of dogfish in great numbers on the Maine coast is confirmed by an article published in a New York newspaper, annexed to this report (see p. 166), which describes these fish as swarming in immense numbers in the vicinity of Old Orchard.

I beg to call the attention of the commission to some considerations respecting the utilization of dogfish for commercial purposes.

Annexed to the report of the United States Commissioner of Fish and Fisheries, for the fiscal year ending June 30, 1902, is a report of Charles H. Stevenson on "The Utilization of the Skins of Aquatic Animals." Concerning the utilization of the skins of sharks, rays and dogfish, Mr. Stevenson says:—

The skins of sharks, rays and dogfish are commonly very rough, and studded with numerous horny, tuberculous markings or protuberances. Some have small imbricated and triangular scale-like tubercles; others unimbricated and nearly rhomboid, which in one species ranged near each other in quincunxes, or they may be quite square, compact, and comparatively smooth on top. These protuberances are usually firmly fixed to the skin, so that they are not easily separated therefrom. They are rough and hard, and take a polish almost equal to stone.

These skins, like those of all cartilaginous fishes, are very durable. A peculiarity, in addition to the markings above noted, is the non-porous character. The pores that are everywhere present in the skins of most mammals, which give the natural grain in the tanned leather, are entirely indiscernible in the skins of these fish. The result is to render them almost proof against water absorption. Although by skillful tanning the fibres of seal and other skins may be plumped and the body of the membrane solidified, yet much water exposure loosens up the fibre and gradually permits absorption. Not being of a porous nature, shark skin is

¹ We found at Canso, N. S., a remarkable scarcity of squid, but an astounding abundance of dogfish.—G. W. F.

naturally free from this defect. But the advantage is also a disadvantage in some respects. The non-porous leather is practically air proof as well as waterproof, and that is a serious defect when its use for footwear is considered. Beyond this, the skins of sharks and similar fishes may be prepared in a very durable, non-cracking leather, for which many uses may be found.

Formerly, large quantities of these skins were used for polishing wood, ivory, etc., for which they are excellent, owing to their roughness, hardness and durability. But the great improvements made in preparing emery compositions and sandpapers have resulted in substituting them almost entirely for polishing purposes. However, a small demand yet exists for shark skins for cabinet workers' use.

The principal uses made of the skins of sharks and allied fishes at the present time are for covering jewel boxes, desk ornaments, card cases, sword sheaths, sword grips, and a great variety of small articles for which the tuberculous markings peculiarly adapt them. The demand for these purposes, however, is small and restricted, and each producer has to develop his own market. Comparatively few of these skins are prepared in the United States, and diligent search among the tanneries and leather stores will result in the finding of only a few skins. Many, however, are prepared in France, Turkey and other countries in southern Europe, and also in China and Japan.

A Parisian manufacturer has made quite a reputation tanning the skin of a species of Malabar shark into morocco; and establishments in Turkey make green leather from the skin of the angel shark found in the Mediterranean Sea. The skin of the diamond shark obtained in the North Sea, and so called because of the shape of the markings or protuberances, is used to cover the sword grips of German officers, and for this purpose is not surpassed by any material obtainable. Some parts of the skin of certain varieties of sharks, when dried and hardened, take a polish equal to that of stone, and bear a strong resemblance to the fossil coral porites, and are much used in the manufacture of ornaments and jewelry.

In preparing them for the use of cabinet makers, shark skins are merely cleaned, and not tanned. The hard, dry skins are soaked in lukewarm water for three or four days, shaved on the flesh side to remove surplus flesh and muscular tissue, and then dried. The skins of some species of sharks are so hard that they cannot be shaved. The appearance of these skins is improved by bleaching, using chloride of lime and sulphuric acid. The durability of some of them is remarkable, outwearing many sheets of sandpaper of equal area.

In tanning shark skin for leather or ornamental purposes, an alum process is usually employed. Each establishment usually has its own particular method, but the general process is much the same, consisting of a preliminary soaking, liming, bating and fleshing, and then tanning or preserving in an alum compound. The hard skins are first soaked in water four or five days, and then in lime water for two to six days, depending on the condition of the texture, temperature of water, etc. The skins are washed free of lime and bated in bran water, then shaved on the flesh side, to remove all excess of flesh and the like. The alum solution in which they are immersed is composed of a pound of alum and one-fifth of a pound of salt to a gallon of water. The skins remain in the solution two or three days, with occasional stirring. On removal they are dried and are then ready for manufacturing.

The subject of the utilization of dogfish for oil and guano is briefly discussed by Mr. B. Frank Gallup of East Boothbay, Me., in a letter to Prof. S. F. Baird. Under date of Sept. 26, 1882, Mr. Gallup wrote:—

Allow me to call your attention to a new industry, started this season on this coast upon scientific principles, and which promises to be a success, providing there is a bounty allowed to fishermen. I refer to the catching of dogfish and making them

into oil and guano. I have paid this season \$1 per 100 fish, and the fishermen claim that the price is too low; yet it is all that I can afford to pay for them, — in fact, all they are worth. My views are that, if the fishermen receive a bounty in addition to the above price, many more would engage in the business, and add their mite to ridding the ocean of these destructive fish. I have this season converted the porgie factory, formerly owned by Gallup & Holmes, into using the fish, and can handle during their stay here say 1,000,000 fish, besides being instrumental in destroying twice that number in young fish, nearly matured.

I beg leave to add that some years ago an establishment was, so I am informed, put into operation at Provincetown for the rendering of oil from dogfish; but the oil so procured proved of so poor a quality that its production did not prove commercially profitable, and the establishment was closed.

I also beg leave to annex to this report a newspaper clipping, which concerns a single phase of the subject treated in this report.

Very respectfully,

PAUL MOULTON CARPENTER.

ENEMIES OF FOOD FISH. — MAINE TRAWLERS COMPLAIN THAT THE DOGFISH IS DRIVING THEM FROM BUSINESS.

[From the "New York Sun."]

The hotels at Old Orchard, Me., have been driven to the conclusion that their supply of fresh fish will have to come from a distance this season. The schooners which used to circuit about the bay do not now seek the mackerel and porgies. Some visitors saw the cause of the trouble a few days ago, in Casco Bay. They had gone out with a couple of old fishermen for a night's trawling. Some new lines had been carefully set, and then the buoyed half mile of line put out a day or two previously was visited. Hardly, however, had the two begun to pass the heavy cord with its dependent lines over the roller in the bow of the boat, when one of them began to swear, and wound up by saying, "No use; I guess dogfish have spoiled the whole thing."

As line after line came up, it was found that all the bait was gone and most of the hooks missing; and many of the cords broken off short. There is no chance to catch one of the thieves at such times, the men explained, when one of them has been hooked in such a manner that he cannot cut the line with his hundred of wedge-shaped teeth. When once the tough skin of the brutes is broken, so that the blood comes, the other dogfish will scent the carrion from an incredible distance, and hurry to the feast.

Near Prout's Neck at the east corner of the beach the school was seen a day later from a coasting schooner. They were chasing an immense drove of small mackerel, young cod and porgies, which were leaping out of the water in every direction, in vain endeavors to escape the implacable enemy. There was some generalship about the attack. The fish were headed into a little bay with rocks at each of its points. The school of dogfish were in a crescent formation, completely cutting off all retreat in the shallow water. The food fish quite realized their hard fortune, and many tossed themselves against the rocks or on to the shore, to escape the teeth of their pursuers. The flashing of the gleaming bellies as the dogfish turned themselves to give play to the mouth

under the pig-like snout was incessant, and like short sticks the back fins stood above water almost as far as one could see.

No one who has not seen them would believe the immense size of these schools of dogfish, or mackerel sharks, as some of the coast fishermen call them. The fishermen say that until a few years ago a pack of 50 would be a large body; now they travel in thousands.

To the ordinary whales and large sharks the men are not unfriendly. These are the big dogs which bring the flocks in where the nets and trawls can get them, for the way of escape from these giants is by the shallow waters. But the dogfish drive them away from the in-shore fishing places to places where the fishermen cannot get at them.

When first taken out of the water they are pretty enough, so far as appearances go. About 5 feet in length, of true shark formation, with straight dorsal fin sticking up some 20 inches, a mouth like a new moon some inches back underneath the snout, of a lovely dark-blue color, shading to white below, long and lean, they have all the lines of aristocratic racers.

All along the coast there are vague grumblings of the need of government intervention. The Canadian government is subsidizing factories which will convert the little sharks into fertilizer. But there does not seem to be very much promise in these attempts.

Suggestions have been made that a good export trade with Europe could be built up in the canned flesh of the pests. The flesh is not at all bad when boiled, and so far as is known the dogfish are not unclean feeders. Possibly it may yet pay the fishermen to catch them and sell them to the canners.

The skin of the dogfish is strong, and as rough as a carpenter's rasp. Small quantities of it are tanned and used for the grips of fine swords and dirks. A few ladies' reticules have also been made from it. If the natural color of the living fish could be retained, there could be no prettier covering for handbags, valises and small trunks, and one would imagine it would be as easy to set a fashion in it as it was in alligator skin.

CONCLUSION.

In closing, renewed emphasis should be laid upon the importance of devising and putting into practical operation some plan whereby the fishermen may receive proper remuneration for the time, labor and capital necessary to bring the dogfish ashore, where the bodies may be made of economic value, thus, by killing, to check the increase of this destructive fish, which is rapidly becoming an additional "white man's burden."

Whatever system may be adopted for controlling this evil cannot be expected to exterminate the dogfish. Yet, if the problem is thoroughly canvassed in all its details and wisely worked out, unquestioned economic value can be attained at a cost merely trifling, when ranged alongside the accruing benefits.

From the wide distribution of the dogfish and its migratory habits, a union of efforts along similar lines will be most advantageous; thus with our northern neighbors, Canada and Newfoundland, we have reciprocal interests in this matter, even if we have no treaties of reciprocity. The type of continental free trade carried on by the dogfish race is immensely prejudicial to the productive economic capacity of the ocean, and must be controlled by as rigorous efforts as are applied to terrestrial pests. The information which we have secured in the preparation of this report compels us to range ourselves with those who are of the opinion that these matters demand national consideration. The actual amount of damage done to the Massachusetts fisheries is a serious handicap to the prosperity of an industry which is a great source of national wealth, and the nursery of our national navy. Similar conditions obtain in Newfoundland, Canada and Great Britain, and are of sufficient importance to warrant an international commission, which may determine upon a concert of effort to control this economic plague.

Finally, we call renewed attention to the following facts:—

1. The annual damage by dogfish to marketable fish and fishing gear owned in Massachusetts is not less than \$400,000 (see pp. 115, 116).

2. This damage falls directly upon the fishing industry, but indirectly and ultimately upon the purchasing public.

3. The inroads of the dogfish upon the profits of the fishermen have at present a decided tendency to drive capable men from our maritime industries. If this continues, the difficulty of securing men for the navy will be greatly augmented. (Massachusetts now furnishes more men than any other State except New York.)

4. This damage is not confined to the coast of Massachusetts, but extends over practically the entire coast of the North Atlantic Ocean. The Dominion of Canada has already made a substantial move. Under the direction of its Department of Marine and Fisheries three dogfish reduction works have been established, for securing oil and fertilizer from the dogfish. The industry of canning dogfish for food is being fostered by the same department, and is developing with abundant promise of success.

5. On our Atlantic coast are numerous glue manufactories and menhaden rendering plants, where dogfish could be converted into oil and fertilizer, provided the catching and transportation of dogfish could be made to yield a living profit.

6. The theory and practice of subsidies and protection to "infant industries" is prominent in the development of these United States. Our fishing industry is to-day sorely in need of a small degree of protection, through a subsidy, bounty or other governmental assistance, whereby an industry may be established which shall make the capture of dogfish as profitable as is the capture of the staple market fish.

REPORT OF THE COMMISSIONERS ON
FISHERIES AND GAME

UPON

THE LOBSTER FISHERIES

AND THE

CAUSES OF THEIR DECLINE.

THE LOBSTER FISHERIES.

IS THE LOBSTER ACTUALLY THREATENED WITH COMMERCIAL EXTINCTION?

If reliance should be placed merely upon the market reports to answer this question, the probability is that the dealers' almost universal answer, "There are just as many lobsters in the market to-day as there ever were," would be accepted as a true index of existing conditions. If, however, we should take a broader survey, and study the conditions in Massachusetts from 1888 to 1905, inclusive, as are shown by the sworn statements of the fishermen of Massachusetts, we would face evidence that the total number of lobsters caught in Massachusetts has declined in the last fifteen years, or since 1890, from 1,612,000 to 426,000; and this, too, notwithstanding the use of the most approved apparatus, *e.g.*, power boats which permit a far wider fishing area, and the stimulus of higher prices which have caused notable extension of the fishing season, *e.g.*, in Maine the lobster fishery is now carried on during every month of the year, instead of during seven or eight months, as formerly.

Official reports from the hatcheries, too, indicate a gradual yet positive decrease in the number of egg-bearing lobsters which can be secured. The aggregate number of egg-bearing lobsters given in the sworn statements of the fishermen was 9,865. This is the basis upon which the figures given for 1888 and the subsequent years were made. This would indicate a tremendous decrease in the number of breeding lobsters, from 70,909 in 1890 to about 10,000 in 1905.

DATE.	Fisher- men.	Traps.	Number of Lobsters above Ten and One-half Inches.	Egg-bear- ing Lobsters.	Average Catch per Pot.
1888,	367	21,418	1,740,850	—	81
1889,	344	20,016	1,359,645	61,832	68
1890,	379	19,554	1,612,129	70,909	82
1891,	327	15,448	1,292,791	49,973	84
1892,	312	14,064	1,107,764	37,230	79
1893,	371	17,012	1,149,732	32,741	62
1894,	425	20,303	1,096,834	34,897	54
1895,	377	17,205	956,365	34,343	56
1896,	453	22,041	995,396	30,470	45
1897,	388	18,829	896,273	23,719	48
1898,	340	16,195	720,413	19,931	44
1899,	327	15,350	644,633	16,470	42
1900,	309	14,086	646,499	15,638	46
1901,	331	16,286	578,383	16,353	35
1902,	410	20,058	670,245	—	34
1903,	309	20,121	665,466	—	33
1904,	326	19,539	552,290	13,950	28
1905,	287	13,829	426,471	9,865	31

DEPARTMENT OF COMMERCE AND LABOR, BUREAU OF FISHERIES,
GLOUCESTER, MASS., Nov. 8, 1905.

DR. GEORGE W. FIELD, *Chairman, Commissioners on Fisheries and Game.*

DEAR SIR:—I submit herewith a brief report of the propagation of lobsters during the current year.

The results of the season's work were very unsatisfactory. Not only was there a large falling off in the collections of egg lobsters, but the quality of the eggs was very poor, causing a much heavier loss than in any previous season. The eggs were not as far advanced in development as in past seasons, and were a month late in beginning to hatch. The eggs also appeared flabby, and lacking in vitality. The severely cold winter doubtless had a great deal to do with these conditions.

The total collections in Massachusetts aggregated 1,450 egg lobsters, which yielded 22,721,000 eggs,—a decrease of 30 per cent. from last year. There were 16,880,000 fry hatched and distributed at various points along the Massachusetts coast.

Appended will be found tables showing the collections from the

several fishing centres covered by our collecting operations, and the distribution of fry.

Very respectfully,

C. G. CORLISS,
Superintendent.

Collections of Egg Lobsters in Massachusetts, 1905, Gloucester, Mass., Station.

LOCALITY.	Egg Lobsters	LOCALITY.	Egg Lobsters.
Gloucester,	174	Boston harbor, including Hull,	256
Lanesville,	59	Boston dealers,	407
Rockport,	363	State boat "Egret,"	139
Salt Island,	40	Total,	1,450
Beverly,	12		

Distribution of Lobster Fry in Massachusetts Waters, from Gloucester, Mass., Station, 1905.

DATE OF PLANT.	Point of Liberation.	Number of Fry planted.
June 24,	Off Salem,	100,000
24,	Off Marblehead,	400,000
26,	Off Gloucester,	600,000
July 1,	Off Salt Island,	750,000
3,	Off Gloucester,	500,000
8,	Boston harbor,	1,250,000
8,	Off Gloucester,	1,200,000
11,	Off Scituate,	2,400,000
12,	Off Gloucester,	600,000
15,	Off Rockport,	1,200,000
18,	Off Beverly,	1,000,000
19,	Off Annisquam, in Ipswich Bay,	1,400,000
20,	Off Gloucester,	1,000,000
21,	Off Manchester,	1,200,000
22,	Off Gloucester,	1,100,000
23,	Off Beverly,	1,000,000
24,	Off Rockport,	850,000
26,	Off Rockport,	330,000
Total, . . . . .	. . . . .	16,880,000

DEPARTMENT OF COMMERCE AND LABOR, BUREAU OF FISHERIES,
WOODS HOLE, MASS., Jan. 23, 1906.

Dr. GEORGE W. FIELD, *Chairman, Commissioners on Fisheries and Game.*

SIR:— Herewith I submit a brief report of the lobster work done at this station during the season of 1904-05.

Early in the season it was decided to try the experiment of collecting about 500 egg-bearing lobsters in the fall, and holding them in live cars floated on the surface. One hundred were placed in two cars and sunk to the bottom of the harbor, part of them being in about 18 feet and the remainder in about 35 feet of water. Three hundred lobsters were placed in live cars, which were floated on the surface during the entire winter. These cars were moored in the outer basin at the station, and during part of the winter this basin was covered with ice over a foot thick. One hundred of the lobsters were liberated in the small basin at the station, and nearly all escaped, only 6 being taken out in the spring. The cars which were sunk to the bottom lost about 25 per cent. during the winter. In all, 292 lobsters were recovered in the spring, and these yielded 2,929,000. The eggs seemed to be of good quality, but did not hatch as soon as others which were collected in the spring from waters of this State, being from one to two weeks later. The total number of eggs received at the station was 17,404,000, and from these 13,016,000 fry were hatched. Of these, 3,132,000 were planted in Connecticut waters and the remainder in the waters of this State. In all 707 lobsters were received from the waters of this State; 105 of these were collected by the employees of this station, the remainder being shipped to us by the employees of your department.

Respectfully,

E. F. LOCKE,

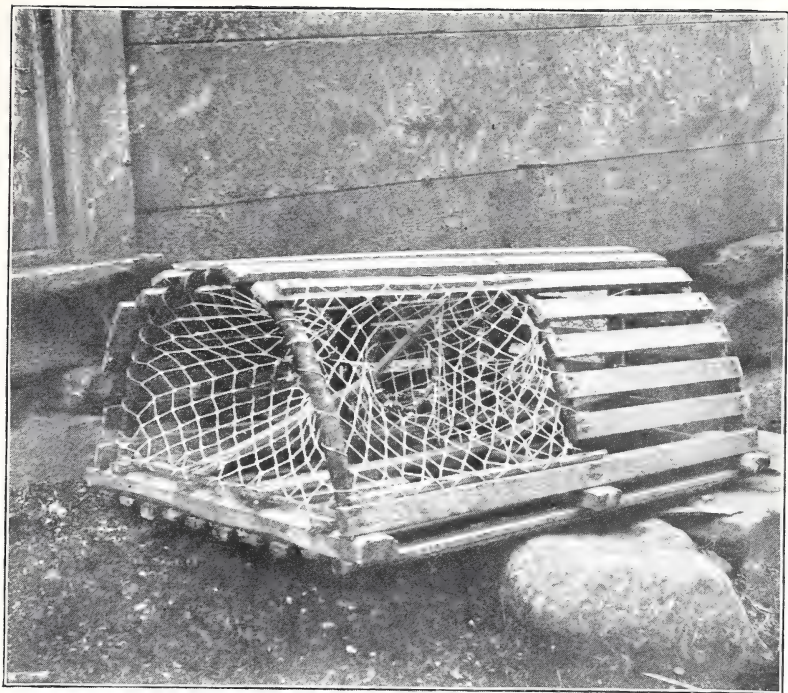
Superintendent.

The following is an abstract of the report of Deputy Foster, of the launch "Egret," in the lobster work. The "Egret" went into service April 26, and was hauled up for the winter on November 29. During this time she ran 447 hours, covering 4,693 miles; collected 2,602 egg-bearing lobsters, of which 1,393 were over 12 inches and 1,209 less than 12 inches, 129 under 10½ inches; liberated 968, 10 died during transportation, sent to Woods Hole hatchery 1,079 (670 were over 12 inches, 409 less than 12 inches), sent to Gloucester hatchery 537 (328 over 12 inches, 209 less than 12 inches).

Received the following lobster fry from Woods Hole hatchery:—

On June 7, 600,000, which were liberated as follows: 240,000 off Davis Ledge, near Minot's Light; 240,000 off Scituate; 120,000 near whistling buoy off Plymouth.

On June 14, received 1,000,000, which were liberated as follows: 285,000 near Harding's Ledge; 330,000 inside Minot's; 385,000 off Scituate.



Lobster trap commonly used in Cape Breton.



Lobster cannery of H. E. Baker, at Fourchu, Cape Breton.

July 1, received 1,600,000, which were liberated as follows: 400,000 near Graves Ledge; 600,000 three quarters of a mile south-southwest from Fawn Bar buoy; 200,000 near Thieves' Ledge; 400,000 near Point Allerton buoy.

From the Gloucester hatchery we received the following fry:—

June 24, 1,000,000, which were liberated between Baker's Island and Pig Rocks.

July 8, 1,250,000 fry, liberated between Pope's Head and Nahant.

July 11, 2,400,000 lobsters, which were liberated between Scituate and Boston Light.

We have let go 580 adult lobsters from hatchery between Eastern Point and Nahant, 430 between Scituate and Boston Light, 205 around Boston islands.

Condition of the Fisheries elsewhere.—Reports, official and from the press, from the Straits of Belle Isle to the Delaware Capes, the entire lobster-producing coast, are well-nigh unanimous, both that the number of lobsters is decreasing and that the average size of the individuals is gradually diminishing. Prof. E. E. Prince, F.R.S., Commissioner of Fisheries of the Dominion of Canada, in 1896 wrote:—

In the Dominion of Canada there remains the last great lobster fishery of the world, and it is not too much to say that this fishery has reached a critical stage.

The signs of exhaustion are unmistakable. Small, immature lobsters, 5 to 8 inches long, which a few years ago were rejected with contempt, are now eagerly taken, and form, in some districts, the staple article on which the lobster canners depend. Instead of two or three lobsters sufficing to fill a one-pound can, not less than five, six, seven and even ten lobsters are now required.

Ten years ago the average size of lobsters was 10 inches (2 pounds weight), while thirty years ago an old fisherman testified that 13 inches ($3\frac{1}{2}$ pounds weight) was the average.

In order to keep up the catch each season, the quantity of gear is being increased year by year all around the coast, yet the average number of lobsters taken per trap has been steadily diminishing.

A prominent packer in Prince Edward Island publicly stated that at one cannery the number of cans packed, as compared with the number of traps operated, revealed that during a period covering six seasons the average number of one-pound cans to each trap was 24 in 1891, $16\frac{3}{4}$ in 1892, $13\frac{1}{3}$ in 1893, $12\frac{1}{2}$ in 1894, $7\frac{1}{3}$ in 1895 and $5\frac{1}{2}$ in 1896.

This kind of thing cannot continue; and the utilization of berried and soft-shelled lobsters is indicative of the desperate means resorted to to maintain an average pack.

The Bangor "Commercial," under date of May 1, 1905, says:—

The outlook for lobsters along the Nova Scotia coast is that they will be the scarest ever known, was the statement made by Capt. J. P. Burns of the lobster smack "Etta M. Burns," which arrived in Portland Wednesday morning with a trip of 12,000 fine, large live lobsters. Captain Burns said that the fish are much scarcer than ever before. There are more smacks here than usual, and more dealers are going into the business.

The Boston "Transcript," on Sept. 5, 1905, says:—

Noank, Conn., September 5: Lobster fishermen in this locality report that the season has thus far been unsatisfactory. The yield of lobsters has been small, even smaller than the harvest of last year. Unless some large catches are made during the few remaining weeks of the season, many of the lobstermen will get no profit whatever from the summer's business. The only condition which has been favorable has been the high price which the lobsters have commanded.

Similar reports could be quoted indefinitely that the same conditions of decline obtain in Maine, New Hampshire, Connecticut, New York and Rhode Island, though in the two latter States the number of lobsters actually caught in the waters of each State cannot be accurately ascertained, for the figures include great numbers of 9-inch lobsters caught in the waters of Massachusetts, Maine and Nova Scotia, and marketed in Rhode Island and New York; thereby an apparently increased catch may be indicated.

It is difficult to conceive a more fallacious argument than the common one that the quantity of fish caught, as represented by the reports of the transportation companies and of the market, is the most accurate indication of the quantity of fish in the ocean. The all important factor in such reports, and one which is usually totally ignored, is the number of men, the amount of gear required to make this catch and the aggregate number of days of fishing. If an annually larger number of men and an increased quantity of gear, working a greater number of days, are necessary to meet the market demand for a specific number of pounds, it can indicate nothing less than correspondingly temporary or permanent contraction of the source of supply; and the market reports of a larger number of lobsters caught is but a more certain proof that the number of lobsters remaining as breeders is thereby still further diminished.

Perhaps the most conclusive evidence is that furnished by actual personal observations of competent persons, whose judgment is unswayed by pecuniary interests. The statement made by our late chairman, Captain Collins, is of value here, as typical of the observations of nearly every one who has familiarly known any particular stretch of sea coast for the past thirty or even twenty years:—

You have been told how easy it was, before the lobster fishery began on the central coast of Maine,—say about 1847 to 1849,—for a boy to pull big specimens of the species from under boulders along the seashore. At that time the waters of that section swarmed with lobsters; the supply seemed inexhaustible; in the inner reaches, among islets and ledges where now it would be of little use to set pots, lobsters could be taken in large numbers fifty years ago. So near were the fishing grounds to where I lived that on one occasion my brother and I hauled our pots in a southeast gale. Where we could get from five to a dozen lobsters to a pot in those days it would now be difficult to catch one in a dozen pots. Those were the days when smacks from Noank, New London and elsewhere frequented the harbors of Maine in search of cargoes of lobsters for the markets of Boston and New York, chiefly those of the latter city.

Then came the destructive canneries. We are familiar with the result of the introduction of the canning factory on the coast of Maine. The influence of it was to gradually reduce the number and size of lobsters. Finally, the canning of lobsters along the coast of that State was stopped.

It was first limited by law in 1897, and the time each year during which canning could be prosecuted was reduced from time to time, until this form of packing could be carried on only from April 1 to July 15, the balance of the year being close season, so far as the canneries were concerned. In this respect the regulations were similar to those now in force in Canadian waters, but they did not avail to delay perceptibly the decadence of the lobster. In 1879 and 1880 I visited nearly every harbor and cove along the coast of Maine, and interviewed hundreds of lobster fishermen. Already there were complaints of a scarcity of lobsters, for, notwithstanding a large increase in gear, the catch per man was not so much as formerly. All this is a matter of history. Still, the yield of the Maine fishery in 1880 was 14,234,182 pounds of lobsters; at present it is only a little in excess of 10,000,000 pounds, although in the mean time the material increase in the price of the lobster has caused an enormous increase in apparatus employed, and also a considerable increase in the numbers of the fishermen.

And again:—

In 1887, when I was at Seldom-come-by harbor, at Fogo Island, off the east coast of Newfoundland, an old fisherman came alongside of the

"Grampus" with a lot of large lobsters that he had gaffed from beneath the boulders along the shore just outside of the sea-wash. Mr. Fred. A. Lucas of Washington, who was with me at the time, as a scientist from the United States National Museum, was in the same region last year [1902] on official business, and he informs me that where the incident I have related occurred the lobster is now very scarce.

Your commissioners have personally inspected many points on the coast of Nova Scotia, Cape Breton, Prince Edward Island, Magdalen Islands and Newfoundland, where the lobster fishery is carried on; and even here, in the very heart of the greatest lobster fisheries of the present day, the opinions of the future of the lobster industry are decidedly pessimistic, if the present methods are continued.

As a result, therefore, of a most judicial and open-minded desire to obtain true facts, we are forced to conclude that there are fewer lobsters in the ocean to-day than there were fifty or even ten years ago. This is true throughout the entire range of the lobster. In the neighborhood of the great markets of New York and Boston the decline is most obvious. In actual numbers there are probably not more than one lobster to-day, where there were ten fifty years ago. But the most alarming fact is that the capacity of the race to rehabilitate itself has been tremendously impaired through the diminished average size of the lobsters at present living. For this reason the total number of lobster eggs annually produced is markedly less than formerly; *e.g.*, an 8-9 inch lobster produces on an average 5,000 eggs; a 13-14 inch lobster produces 30,000 to 40,000 eggs at one laying. Therefore thirty years ago, when the lobsters averaged above 13 inches long, the egg-production was as an average at least twice to four times what the average female lobster produces to-day, when the size of the lobsters which are taken in the traps averages about 9 inches, or even less. From this it is obvious that it will require a closed season of a long period, say not less than five years, for the lobster race to regain its former productive capacity, and a still longer period before any lasting results can be secured.

The decline has, in our opinion, been rendered less conspicuous through the efforts of the United States Bureau of Fisheries, of the Ministry of Marine and Fisheries of Canada, and of the

State governments of the New England States, notably Maine, Rhode Island and Massachusetts, to protect and to propagate the lobsters on their coasts.

As a result of our investigations, we are of the opinion that there has been a decided decrease: (1) in the number of lobsters living to-day as compared with ten years or even one year ago; (2) in the average size; (3) in the number caught per pot; (4) in the number of lobsters of breeding age; (5) in the aggregate number of eggs laid, upon which the future of the lobster depends; there is (6) marked evidence of the absence of lobsters from extensive areas where they were formerly numerous.

We are of the opinion, too, that the methods employed up to the present time have been rendered inadequate by lack of attention to certain laws of nature (to which reference is made later; compare pp. 190, 197, 199, 203, 205), and this, too, in spite of the conscientious study and well-considered activity of the officials of the United States Bureau of Fisheries and of the various States, who have earnestly attempted to check the decline, and whose efforts have the confidence and the support of every honest national and State legislator.

Causes of the Decline. — Since this decline is a fact, and not a theory, let us consider the existing conditions surrounding the lobster industry, for within these conditions must exist the causes for the decline, and the decline can be checked most readily by modifying the conditions.

First, let us be so open-minded as to consider the real meaning of the report that the catch of one year exceeds that of the previous year: *e.g.*, reference to the table on p. 174 shows that the catch in Massachusetts in 1890 exceeded that of 1889, that of 1893 exceeded that of 1892, that of 1896 exceeded that of 1895, that of 1900 exceeded that of 1899 and that of 1902 exceeded that of 1901. This does not prove that there were more lobsters in the ocean in one year than another, — it merely indicates that more were caught; the cause of this increase is shown in the table. In each year where an increased catch appears it is found that there was also an increased number of men employed in the catching, except in 1900, where there were 18 men (a relatively small proportion) less than in 1899. No one can rationally contend that an increased catch in any

one or two years can be an argument to prove an increase in the number of lobsters, especially when the figures for the annual catch prove to-day, in spite of really greater efforts, less than one-third as many lobsters were caught last year than were taken in 1888. In 1902 the yield had shrunk to 1,005,367 pounds, valued, at the then prevailing price of 11 cents per pound, at \$110,590.37. The decline is now even more rapid. The catch of 1905 from the sworn returns was 426,471 lobsters, which at the present price of 18 cents per pound were sold by the fishermen for \$95,955. A comparison of the returns of 1904 and 1905 indicates that during the past year there has been in the lobster industry of the State a decline of 39 men; 56 boats, valued at \$3,893.50; 5,710 pots, valued at \$6,376; \$478.35 in other property; and, further, a decreased catch of 125,819 lobsters, and an income diminished by \$22,065.57. Therefore, we must carefully consider the value of such testimony, and the catch of one season is not a safe criterion.

Conditions introduced by Man responsible. — In the natural struggle for existence the lobster was formerly a dominant animal. Before man became its greatest enemy, there is abundant evidence that the lobster was a favored race. But with the coming of the white man the balance of nature was upset, and the lobster is now decreasing on account of the conditions introduced by civilized man. Such conditions surrounding the present lobsters can be grouped under two heads. (1) The increased market demand, arising from an increasing population and accumulated wealth, with a demand for toothsome dainties, entirely apart from their value as a food. This demand has not been met by a correspondingly augmented source of supply. (2) The other condition introduced by man is the laws in force since 1873, which, although slightly modified in detail, have the same fundamental principle.

The Increased Demand. — The extent of the increased demand is indicated by the fact that the public are willing to pay a price treble and quadruple that of ten years ago; and this in spite of the fact that, on a basis of 20 cents per pound for boiled lobster 10½ inches or over in the shell, the actual cost of the edible meat is not less than 80 cents per pound upon the table of the consumer.

This increased demand has led to a great development in the methods of lobster fishing; to the use of more traps by a larger number of men, who find that the advancing price compensates for the increasing scarcity of marketable lobsters. By the application of power to sail boats and dories the radius of the fishing grounds is vastly increased, and the labor and the risk from stress and storm much lessened. Improved methods of shipment have been devised, where, by means of ice, tanks and refrigerator cars, lobsters can be satisfactorily shipped two or three thousand miles. The increased demand, too, has led to the selling of a greater number of "short" lobsters. Whether the laws of the States legalize the catching only of those above $10\frac{1}{2}$ inches, or 9 inches, or 8 inches, the catching of "shorts" below any of these figures¹ goes merrily on, in spite of the best efforts of those entrusted with the enforcement of the laws. We found the same state of affairs in Newfoundland, in Nova Scotia, on the shores of the Gulf of St. Lawrence and in the Bay of Fundy, as in New England waters.

Commissioner Nickerson of Maine says: "There is a greater demand for short lobsters to-day than ten years ago."

The ever-increasing number of summer residents on the New England sea coasts, in cottages and in hotels, the multitudes of hungry excursionists from our cities, coming by train, trolley and steamer to the shore resorts, are the direct incentive to the sale of millions of illegal lobsters. A person who is competent to observe and to form a trustworthy judgment estimates that during the summer season of 1905, covering about one hundred days, not less than 1,720,000 short lobsters were sold at the resorts on the shore between Boston and Gloucester. The commission's patrol launch "Scoter" was instrumental in compelling the return of upwards of 900,000 short lobsters to the water during the summer of 1905 in Boston harbor alone.

¹ As an indication of the size of lobsters used by those engaged in the short-lobster trade, the measurements of the "shorts" seized in two cases taken at random are of interest. In one seizure of 58 "shorts," taken south of Cape Cod, the smallest was 6 inches; 14 measured 8 inches or less; 37 measured 9 inches or less; and 7 were less than $10\frac{1}{2}$ inches but over 9 inches. In another seizure of 128 "shorts," taken north of Cape Cod, the largest lobster was 10 inches, the smallest $6\frac{1}{2}$ inches; 48 measured 8 inches or less, 87 measured 9 inches or less and 23 were over 9 inches and less than 10 inches.

In Maine, Warden N. J. Hanna, who has been a warden for more than twelve years, and who previously had been a practical fisherman, is of the opinion that annually 10,000,000 short lobsters are used as bait for cunner traps, and that over 5,000,000 short lobsters are consumed by the summer visitors, — a total of not less than 15,000,000 “shorts” destroyed in Maine annually; and this does not include “the few taken home by very many fishermen for the use of their own families.” The handling of short lobsters has developed into a business, so thoroughly organized that detection and the imposition of fines sufficiently large to make the business unprofitable is a difficult matter. Our judges sometimes fail to recognize the value of a heavy penalty, which, though sometimes bearing heavily upon the individual punished (in many cases the fine imposed is paid by the principals in the business rather than by their agents who have been arrested), would be of the nature of a warning; *e.g.*, the paltry fine of \$25 imposed last September upon a notorious violator, who had long been under the surveillance of our deputies, for the possession of 128 short lobsters, was a severe blow to the efficient enforcement of the lobster law.

The schemes for outwitting the deputies and of evading the short-lobster law far excel the peculiar ways of Bret Harte’s “Heathen Chinee.” In general, since to secure conviction it is necessary to seize the short lobsters while in possession of the offender, the illegal lobsters are kept where they can readily be thrown overboard in case a deputy appears. Our deputies have compelled the fishermen thus to throw overboard at least one million “shorts” this year. In case a deputy does not appear, the “shorts” are placed in a sunken bag or car, the location of which is marked by a buoy kept just under water, or by an inconspicuous floating object which would attract no special attention, such as a bit of wood, kelp, etc., or the bag or car may be hung by a small line over the stern of a boat, or to a boat-mooring, or pile under a wharf. When 50 to 500 “shorts” have been accumulated, these are taken in the night by regular collectors who ply along the shore from Rockport to Plymouth. Some such have been driven so hard by our deputies as to go out of the business, but “there are others.” They have a well-organized system of sentinels and spies, who keep track of and

report the movements of the deputies. The fines imposed by the judges, even at the maximum, are small when compared with the profits; and usually this amount is reckoned as a contingent expense of the business, and is divided among those participating in the profits. Most of these lobsters are marketed as "lobster meat." The following report from Deputy Burney indicates how the law is evaded during the summer at many places along the shores between Boston and Gloucester:—

LYNN, MASS., Aug. 1, 1905.

Commissioners on Fisheries and Game.

GENTLEMEN:—Complying with your request, I make this report of my observations upon the short-lobster traffic on the shores of Massachusetts. The enforcement of the lobster law is becoming more difficult each year, on account of the methods adopted to evade it by the lobster fishermen on the north shore.

In the past it was the custom of the fishermen to *land* their catch; then it was a comparatively easy matter to catch the violators. At present, landing the catch is dangerous, and in some cases a very costly way to dispose of their lobsters. The fishermen have adopted ways of avoiding that. It was soon found that there was a growing demand from the beach houses and hotels along the shore for lobster meat out of the shell. Raw meat soon became too dangerous to handle, and other means had to be found. The new way is an evasion of the law, and it is relatively safe. There are two ways to work it: one is to cut up the raw meat into small cubes, when it is impossible to show to the courts that it is lobster tails; the other is to scald the lobsters on board the boats, cut the meat up, and land it in pails and firkins.

There has been but one conviction (in my recollection) on scalded meat, and that was on meat *not* cut up.

One or two instances are sufficient for examples of what happens nearly every day during the summer season. On Wednesday, July 19, I was at Salem Willows. Two boats ran in on the Beverly side and anchored a short distance off shore. I could see very plainly with my glass every move of the men. They were busy for more than a half hour, shocking out and cutting up lobster meat and putting it into firkins. When they had finished, the meat was taken by one of them to the restaurants at the Willows. They were not gone over ten minutes when another boat came from the Beverly shore and did the same thing.

Tuesday, the 25th of July, off the Magnolia shore, I saw two sloops at anchor, their crews busy "shocking" and cutting up meat. This is something that can be seen almost if not every day. In past seasons it was common talk that a man could run down to the nearest beach any morning early and get a mess of shorts. I am asked quite often, "Where are all the shorts? I used to get a mess once in a while, but I can't get them now." I venture to say that where there were hundreds of short lobsters landed every day five years ago, there is not one dozen landed to-day. Of course there are some men who *will* take chances, but they are few. Where a man can sell his shorts off shore to the boats en-

gaged in buying shorts, he will not bring them ashore and take chances. A number of lobster fishermen with whom I have talked say that this is the poorest season they have ever had.

Yours respectfully,

THOMAS L. BURNEY.

On the south shore of Massachusetts some "shorts" are handled locally, but the greater number are shipped to Rhode Island and New York, being landed at Newport. Every boat and every stranger is carefully scrutinized, to learn if he is "all right;" and at the slightest suspicion the signal is passed to "stand by to heave the 'shorts' overboard."

The public is largely to be blamed for this condition of affairs. The seashore public creates the demand. It is a common practice to leave baskets outside the doors, where in the early morning short lobsters "descend like manna from heaven," at the rate of 50 cents to \$1 per dozen, according to risk of detection. People who carry on such practices might not steal private property, but they thus steal public property. A finer public sentiment should develop. To the unthinking, the attitude of the State appears to be directed solely against the poor fishermen, in a rather petty way. On the contrary, the State is doing its duty in protecting public property and the interests of the fishermen. Too often the fisherman discounts the future by excessive greed in destroying fish, for fish means money.

The public, however, should be particularly warned, and in no uncertain terms, against the use of "lobster meat," i.e., lobster meat which is taken from the shell at a distance from the place where it is consumed. The State Board of Health and the local health boards in every town and city are distinctly and earnestly urged to deal with this lobster meat problem. The facts are as follows:—

Lobster-meat Problem.—Ever since the law prohibiting the killing and possession of short lobsters has been in effect, the fishermen and consumers of lobsters have devised all sorts of expedients to use short lobsters in violation of the law, and to escape detection by the officers. A most common scheme (described on p. 185) is to boil the lobsters on board the boat, remove the meat from the shell, cut up the meat in such a way as to destroy all evidence possible as to the size of the lobster, and bring the meat ashore. This meat is then sold by the pound to private

customers, to hotel and to restaurant keepers and to near-by city, town and shore resorts. This practice is not alone a screen for the "short-lobster trade," but it is a positive and serious menace to the public health. Numerous severe and even fatal cases of ptomaine poisoning can be traced directly to the use of the lobster meat prepared in this manner; *e.g.*, one day's record is given below:—

Hull, September 1: Francis H. Cleverly of the Hull board of health went over to Fort Andrews at Peddocks Island this morning, and obtained for the first time from Dr. Luke B. Peek, the post surgeon, who attended Antonio Gomes, Joseph Oliver and Joseph Oliver, Jr., who died on the island Sunday morning, a doctor's certificate.

In the doctor's certificate Dr. Peek states that to his best knowledge and belief the cause of the death of all three was ptomaine poisoning, from eating lobster that was supposed to have been decomposed.

The board of health will accept the cause of the death of all three as attributed by Dr. Peek as final, there having been no autopsy. (Boston "Globe," September 2.)

Lynn, September 1: After attending a banquet at which lobster salad was served, several of the great chiefs of the Improved Order of Red Men, who were guests of Winnipurkitt tribe in this city last night and to-day, were taken ill, and in many cases had to call in physicians.

The one who suffered the most from what the physicians call lobster poisoning is Frederick Williams, 84 Tracy Avenue; the others who were compelled to call in physicians are William Embree, George Eastman, Roscoe Patton, Jacob Steadman, E. L. Hiller and W. J. Spoonley. These are all members of the Lynn tribe, and it is not known how many of the visiting great sachems have been affected.

Williams and Spoonley were taken ill while attending the outing tendered to the visitors to-day at Nahant, and forced to leave for home long before the rest of the party. On arriving home they went immediately to bed and called in their physicians. The others who did not attend the outing were taken ill about the same time. Others of the party were affected, but in a less degree.

It is said by the caterers that none but the best lobsters were used in the salad, and that they cannot imagine why any serious effects should be felt. The lobster was bought for fresh, and it was not canned, as was alleged by many of the members of the party; in fact, much of it was bought at the fish market of one of the members of the committee. The other edibles were also fresh, nothing being used that had ever been canned. (Boston "Globe," September 2.)

These facts should be known to the public, and specific warning given as to the danger to health and even to life of such methods of placing lobsters on the market. Every responsible hotel or restaurant manager should refuse to buy lobsters unless

either in the shell or canned, and customers should object to being served with lobsters at such hotels or restaurants as do not conform to practices which safeguard the life or health of patrons. It is a well-known fact that crab and lobster meat spoils very quickly after exposure to the air. The reason is that the texture of the meat is very loose and spongy, with many spaces through which the air penetrates. This air carries the bacteria which cause putrefaction and the rapid development of certain ptomaines which are virulent poisons even in very small quantities. The bacterial changes which give rise to ptomaines progress most rapidly at about the temperature of ordinary ice chests; *e.g.*, at about 50° F. Ptomaines may develop without the presence of an offensive odor. In the case of the properly boiled lobster, kept in the shell until ready to serve, these changes do not begin so quickly or progress so rapidly, for the reason that adequate boiling sterilizes the shell and the meat, and the sterilized shell protects to a considerable measure the meat enclosed within it so long as the shell is unbroken. Upon removal of the shell the air has readier access to the meat, and ptomaine formation or putrefaction soon ensues; therefore, the shell should not be removed until close to the time for serving the meat. In the case of lobster meat removed from the shell at some distance from the point of consumption, the length of time between the removal from the shell and the appearance of the meat upon the table is in many instances too long for safety. Further, lobsters boiled and prepared under such unfavorable, not to say unclean, conditions are not only often imperfectly sterilized, but also liable to infection from unsanitary surroundings and careless handling, and therefore much more liable to rapidly develop ptomaines. Unclean handling, filthy receptacles, etc., may also introduce the germs of typhoid and other serious infectious diseases. Our deputies are using every effort to make this practice of using illegal lobsters unprofitable, and special attention will be directed to cases where lobsters are sold as meat. But the most effective remedy is a public knowledge of the dangers of ptomaine poisoning from the use of "lobster meat" or "picked meat," taken from the shell in places unknown, and at any considerable period of time before being prepared for the table. Purchasers should therefore be warned

against buying lobster meat unless it is in the shell or canned; and, in buying lobster, never buy one which was boiled after death.

Many of the lobsters which die in transit, together with the “sleepy” (*i.e.*, moribund) and the “Joe” (*i.e.*, crushed or otherwise mutilated) lobsters, reach the consumer as “picked meat.” Such should be bought very cautiously, for the reason that the history of the preparation of it is unknown. “Hash” is said to be above suspicion only “when you know the lady as made it;” but in the case of “picked meat” and “lobster meat” you should in addition know the condition of the lobster and the sanitary conditions under which the meat was prepared, together with the length of time since this preparation.

The sale of lobster meat, therefore, is a serious menace to the lobster supply; it is a burden upon the law-abiding lobstermen and lobster dealers; and, above all, it is a positive menace to public health. The public should demand that lobsters be sold only in the shell or canned. It would be for the great advantage of the public if the present Legislature should pass a law similar to that now in force in Maine, which is as follows:—

All lobsters or parts of lobsters sold for use in this state or for export therefrom must be sold and delivered in the shell, under a penalty of twenty dollars for each offence; and whoever ships, buys, sells, gives away or exposes for sale lobster meat after the same shall have been taken from the shell, shall be liable to a penalty of one dollar for each pound of meat so bought, sold, exposed for sale, given away or shipped. Any person or corporation in the business of a common carrier of merchandise who shall knowingly carry or transport from place to place lobster meat after the same shall have been taken from the shell, shall be liable to a penalty of fifty dollars upon each conviction thereof. All lobster meat so illegally bought, shipped, sold, given away, exposed for sale or transported shall be liable to seizure, and may be confiscated. Nothing contained herein shall be held to prohibit the sale of lobsters that have been legally canned.

While the greatly increased demand without an adequately increased source of supply, involving, as it does, more carefully devised methods of increasing the catch and of utilizing every possible source of supply, — *e.g.*, the legal killing of large lobsters and the illegal killing of short lobsters, and evasion of the law through the practice of preparing and selling illegal sized lobster as “meat,” — is responsible to a considerable de-

gree for the decline of the lobster supply, the most important factor has been generally overlooked, — the *present laws*.

Effect of the Present Laws. — These laws have been in force since 1873, supplemented by a close season in Canadian waters, by the prohibition of canning in Maine, by the prohibition of the killing of egg lobsters in all the States, and strengthened by the efforts of the States and national authorities to secure the purchase of the eggs upon the egg-bearing lobsters taken in the traps, thereby making such lobster legally salable to the agents of the State and the United States Bureau of Fisheries. For the initiation of this practice of purchasing egg-bearing lobsters from the fishermen at a price above that of the market, due credit should be given to the United States Bureau of Fisheries. This practice has resulted in the hatching of millions of eggs which otherwise would have been scraped off and destroyed.

In spite of arrests, imprisonment and fines in all the States and Maritime Provinces for violating the lobster laws, the decline in the lobster supply has continued, and is no longer disputed by those best capable of formulating an unbiased opinion. Upon examining the lobster laws of all the States and of the Maritime Provinces, it was noticed that one glaring biological error is prominently common to all, viz.: *in every case the efforts are directed to protecting the immature, under the fallacious assumption that the fundamental source of the lobster supply is the young lobster, which by growth will become of legal size for market; whereas, in point of biological fact, the fundamental source of supply is not the young lobster, which in and of itself alone is to furnish the market supply, but the search must be carried back one more step. It is the egg which is the ultimate source; and the future supply of young lobsters which by growth may be expected to furnish the marketable supply is at the basis dependent upon the number of eggs produced.* Thus, by instituting a law that only those above a certain size shall be killed, we have committed a blunder similar to that which would be patent to every one if by practically uniform legislation it should be decreed that only poultry should be marketable which had reached the breeding age, and that every effort should be made to place every bird of

breeding age upon the market within the shortest possible interval after reaching maturity.

To make this plain, it is necessary to bear in mind certain important facts in the life history of the lobster. For most of these facts the public is indebted to scientists connected with the United States Bureau of Fisheries and the Rhode Island Commission on Inland Fisheries, notably professors F. H. Herrick, H. C. Bumpus and A. D. Mead, and the students working under their immediate direction.

(1) The lobster grows rather slowly, and it is at least four or five years old before reproduction begins.

(2) The natural rate of reproduction is slow. One litter of eggs is produced, under favorable conditions, according to Herrick, every two years, instead of annually; there is, however, a possibility that the large lobsters, say 12 inches or over, which do not moult so frequently as the smaller sizes, may produce a litter of eggs every year.

(3) The growth is not gradual, as, for example, in the case of chickens. On the contrary, only at the time of shedding does a very marked increase in size become evident. By actual observations and measurements, Herrick found that the average increase is 15.6 per cent.; *i.e.*, a 6-inch lobster upon moulting becomes a hard-shelled 7-inch lobster within a month, and similarly a 9-inch lobster may become a 10½-inch, and a 10½-inch may become a 12-inch lobster.

(4) The area inhabited by the lobster is a restricted one. They are not migrants in the sense that mackerel and bluefish are. The only migration is from deeper to shallow water during the period when the eggs are hatching, — June and July. Under modern methods of capture the lobster is pursued by its chief enemy, man, throughout the year, though most actively and by the greatest number of fishermen during the summer months.

(5) The eggs are not laid and abandoned, but are carried outside of the body, attached to the swimming feet under the abdomen, for ten to eleven months, which is the time required for the development of the young in the egg.

On both biological and practical grounds the present laws intended to govern the lobster industry cannot be arraigned too

strongly. In addition to including the biological fallacy that the breeding animals alone should be killed, it is a law which is well-nigh impossible to enforce. A. C. Bertram, Esq., inspector of fisheries for Cape Breton, has well said, "It would require an officer in each boat to prevent illegal work." Some of the devices by which the law can be evaded have been referred to above (p. 184). Not less than 2,000,000 illegal lobsters have been annually killed in this State in the past three years; in Maine, not less than 15,000,000 per annum; in the Maritime Provinces, including Newfoundland, practically every lobster caught, large and small, is retained. The officials seek to save only the egg-bearing lobsters. The coast line is so extensive and the lobsters so numerous that little attention can be devoted to the detection of illegal practices. The lobster fisheries of Canada are now practically what the Massachusetts, Rhode Island and Connecticut lobster fisheries were fifty years ago; but now a positive decline is seen to be impending, even there, and evidences of the increasing scarcity of lobsters are beginning to appear. This decline shows the same features in Canadian waters as in Massachusetts waters, viz.:—

(1) Decreased average size.

(2) Diminished catch per trap.

(3) The practical disappearance of lobsters from regions where they were formerly plentiful. Just as in the New England States lobsters first disappeared from the regions nearest the markets, so the decline is most marked near the settlements.

(4) A decreased number of egg-bearing lobsters.

(5) An increasing price.

Our Canadian brethren appear to have been the first to be impressed with the necessity of protecting the adult lobsters, for the purpose of securing a natural method of hatching. It is true that the United States Bureau of Fisheries has for many years bought the egg-bearing lobsters, but the chief claim has been that by so doing they were able to hatch millions of eggs which otherwise would have been scraped off by the fishermen for the purpose of marketing the mother lobster. The claim is not seriously put forward that the artificial hatching of lobster eggs is preferable to the natural method.

The closest approximation to the natural methods is that now



THE LOBSTER POUND OF H. E. BAKER, AT FOURCHU, CAPE BRETON.

in operation on the east coast of Cape Breton Island, not far from Louisburg. The general plan was well stated by R. N. Venning, Esq., at the convention in Boston, in 1903, as follows:—

In connection with efforts to maintain the supply of lobsters by methods of artificial propagation and protection of the breeding fish, an interesting experiment was this year [1903] initiated at Fourchu, Cape Breton County, N. S., under the auspices of the Department of Marine and Fisheries. An arrangement was made with Mr. H. E. Baker of Gabarouse, a large operator in the canned and live lobster trade in Cape Breton Island, for the utilization of his lobster pounds at Fourchu, which were partitioned off for the reception of lobsters of different classes and in different stages. (See illustration opposite.)

The principle of the scheme was to purchase from the fishermen 50,000 desirable seed lobsters, and place them in a suitable pound for protection, where they could be retained and fed during such time as fishing operations were proceeding; after which, or when the eggs were sufficiently advanced, the lobsters were to be liberated along the coast whence they were taken, thus permitting such of them as had not already cast their fry in the pounds to hatch their eggs in their natural haunts, in conformity with the strict methods of nature.

A specialist of the department was sent to inspect the working of the scheme, and on the 5th of August he reported that the eggs were hatching out in millions within the enclosures of the pounds, and the young lobsters were making their way through the wire netting into the sea. At the time of his visit there were still in the pounds about 20,000 berried lobsters, the eggs of which were in various stages of development, while the enclosure was teeming with vigorous, newly hatched fry.

It is perhaps not too sanguine a conclusion to say that, so far as can be proved by the facts actually observed in the experience of those charged with the conduct of this experiment, its result was a complete success. At all events, these 49,769 mothers, with their progeny, were at least saved out of the actual catch of the fishermen, and would otherwise have found their way to the markets, either as canned goods or exported alive, after the eggs had been raked off.

In October, 1905, the chairman and Commissioner Delano had the privilege of inspecting this pound, under the guidance of Messrs. A. C. Bertram, inspector of fisheries for Cape Breton, H. E. Baker, owner of the pound, and the Hon. Alexander Johnston, M.P. The method of construction is shown in the illustration. The area is approximately one acre. The location is admirably chosen, both on account of being a natural resort of lobsters during the hatching season, and also because the currents are such that the just-hatched and helpless lobsterlings are scattered over a wide area in all directions by the gentle currents.

The results can scarcely fail to be of future benefit in assisting to check the decline, as well as of present benefit to the lobster fishermen by providing a ready legal market for egg-bearing lobsters, thus reducing the temptation to scrape off the eggs for the purpose of evading the law. Mr. Bertram, at the convention, in 1903, supplementary to the statement of Mr. Venning, quoted above, said:—

What we all desire to do, it appears to me, is to consider the question of keeping up the supply. I may say that in the early '80s we began by hatching out lobsters by artificial means, with what we called an incubator. I think that this system of hatching lobsters was originated in Newfoundland by a Mr. Neilson. The first incubator was a wooden box, with a perforated, metal bottom, about $3\frac{1}{2}$ feet in length, made like a cradle, which he anchored in the bays and harbors; the motion of the water would keep it rocking, and this hatched the lobster fry, which would escape through the perforations of the car. There were no beneficial results from this system, and we soon abandoned it. Last year a pound was created on Cape Breton Island, costing about \$5,000.

The greatest drawback that we have discovered for keeping up the supply was that the fishermen cared not what happened to-morrow, so long as they were provided for to-day. It would require an officer in each boat to prevent illegal work, and it was very hard to detect them when the spawn had been rubbed off each egg-bearing lobster.

With this pound system we buy up the egg lobsters from the fishermen; such lobsters are put in cars by the packers, and a boat goes around the coast and takes up the lobsters that are in the cars and carries them to the pound. We leave them there until the close season begins, then we liberate the lobsters from the pounds; therefore, those fish would have time to spawn. Then, when the close season begins in another section we take the egg-bearing lobsters out of the pound and liberate them along other sections of the coast, and then they spawn annually.

I believe that this is the right system. I am thoroughly convinced that our government is warranted in any reasonable expense for this. Ten thousand dollars for this was appropriated this year.

The following extract, from Professor Prince's report on "Fish Breeding," is of importance in this connection:—

The lobster pounds operated by Mr. H. E. Baker of Gabarouse, Cape Breton, under the department's auspices, were again very successful. The lobsters, according to the contract, were collected from the fishermen by Mr. Baker in his business as a lobster packer, excepting that he employs extra tug assistance and sailing smacks and special hands, and selects fine seed lobsters,—that is, female lobsters bearing eggs. These were carefully carried, not to the cannery, but to the reserve

tidal pounds at Fourchu, Cape Breton, and after the commencement of the close season were replaced in the open sea, so that they might incubate and hatch out their eggs under natural conditions. On July 22, the first batch of seed lobsters were liberated, to the number of 24,800; and between July 30 and August 13, 31,820 more lobsters were set free in the sea, being scattered over the known breeding resorts of these valuable crustaceans. During their confinement in the pounds the lobsters were fed with herring and other food. Some mortality is of course unavoidable; but this was last year kept very low, but was slightly higher this year, as the report of the officer in charge on behalf of the department shows. Mr. H. C. V. LeVatte stated the mortality as follows:—

	1903 (Per Cent.).	1904 (Per Cent.).
May,	2½	2½
June,	3½	3¾
July,	4	5¾

The increased mortality in July this year was due to the extreme heat of the sun, and the only remedy was the removal of the lobsters, which were placed in crates and conveyed to deeper cooler water, where the death rate at once decreased and the sickly lobsters recovered. "The natural propagation of lobsters," says Mr. LeVatte in his report, sent to me on December 31, "will no doubt materially increase the supply on this coast, and I consider Mr. Baker's scheme has proved a success." Of course the system adopted at Fourchu is a somewhat complicated one, and can only be satisfactorily adopted where the skill and experience of trustworthy parties can be secured. Mr. Baker is a lobster packer of long and unusual experience, and in his hands a scheme involving the handling, transference in crates, planting in the tidal enclosures, feeding and care and final retransplanting in the sea again, can be carried out with a greater measure of success than in most localities. The department also authorized one of its officers to supervise the work, and furnish proper reports of the progress of the operations of impounding and of replanting in the ocean. The system is so open to abuse that in many localities it could not possibly succeed so well as it does on the Cape Breton coast.

While this method comes nearest of anything thus far attained to the prime necessary condition, viz., the utmost possible protection to the adult lobster, it is open to the following objections:—

(1) The escape of millions of young, just-hatched lobsterlings from the interstices of the pound cannot fail to attract

fishes, which devour enormous quantities. This is a most serious objection, when it is borne in mind that under natural conditions but a few eggs hatch at a time, and, as the mother lobster crawls along the ocean bottom, the young escape in such small numbers as to be of slight evidence to predaceous fish. If no trail is left, comparatively few fish are attracted, and relatively few young are thereby destroyed. If it proved expedient to develop this method, smaller and scattered pounds, favorably located, will, in our opinion, yield better results than a single large pound.

(2) The second objection lies in the fact that the fishermen are paid at the expense of the public for doing what is obviously for their own interest.

(3) The plan does not extend far enough. Not a sufficient number of individuals are protected, and these only of one sex.

(a) It is of equal importance to preserve the males which are of breeding age, for nature has established the proportion of male to female lobsters, necessary to insure fertilization of the eggs, at approximately equal numbers. Herrick puts it at 100 males to every 106 females, and the observations of the writer confirm this. (b) Not *all* the females of breeding age are included. Our observations indicate that not over 20 per cent. of the mature females are thereby protected. *If it is an advantage to protect some of the female lobsters, it must be of greater advantage to protect all of them.* The method pursued by the Bureau of Fisheries for many years, and two years ago adopted in Massachusetts, of buying the egg-bearing lobsters and hatching the eggs artificially, is open to all of the above objections, and to the more serious one that artificial hatching, if followed by the liberation of the just-hatched fry, appears to the writer to be far inferior to the natural methods. The chief value which can be claimed for this method is that many lobsters are carried off shore and liberated, where the eggs hatch under natural conditions.

The method devised by Dr. H. C. Bumpus and elaborated by Dr. A. D. Mead and his assistants is a distinct advance, for the reason that it aims to rear the lobsterlings past the age when they float helpless at the surface of the water, a prey to surface-feeding fish. This method should prove of great value in eluci-

dating in a scientific manner the natural history of the lobster. Its limitations are found in the commercial impracticability of operating on a sufficiently large scale at a satisfactory cost.

The problem which must be solved is nothing less than the checking of the decline of the lobster supply, and restoring the lobster to the position which it formerly held, as wholesome and delicious food for the people at large, rather than to permit it to become merely a delicacy to grace the banquet table. The methods now available must be through legislative action, affording practical assistance to nature in increasing the efficiency of natural methods. *Legislative action must be either in the direction which promises to lead to increasing the egg production of the race, or to the control of the lobster's enemies, of which man is the chief.* Action on both these lines would promise most satisfactory results. Such laws, to be effective, must be judged by the probability: (1) of their leading to an increase in the supply of lobsters without limiting the present demand; (2) of appealing to the common sense of the people, as likely to secure the results aimed at; (3) of rapid, efficient, equitable and inexpensive enforcement; (4) of working the least possible injury to important vested interests, both of fishermen and dealers; (5) of furnishing the most satisfactory market conditions with reference to the public demand in regard to size, season, price, etc.

Legislative Action which seeks to increase the Reproductive Capacity of the Lobster must protect the Adult. — Attention has been called above (p. 190) to the fact that the actual source of maintenance of the supply of legal and marketable lobsters is only *indirectly* those lobsters which are just below the legal length (and which, if spared, would become of legal length in a brief time). The direct and fundamental source is the eggs, from which come the small lobsters; and therefore the number of future marketable lobsters depends directly upon the number of eggs laid. Herrick has shown that the egg-producing capacity practically doubles three times in the growth from 8 to 14 inches, being for an 8-inch lobster an average of 5,000 eggs; 10-inch, 10,000; 12-inch, 20,000; 14-inch, 40,000. "A 17-inch lobster produces about 63,000 eggs," on an average. "The largest number recorded was 97,440 eggs. In one case

the lobster was 15 inches long, and in another 16 inches long." This proves that the more valuable lobsters for egg-production are those above $10\frac{1}{2}$ inches long, and that the number of eggs produced is very greatly influenced by the number of breeders above $10\frac{1}{2}$ inches. Herrick found that "female lobsters become sexually mature when from 8 to 12 inches long. The majority of all $10\frac{1}{2}$ -inch female lobsters are mature. In 100 dissections 25 females were found, from $9\frac{5}{16}$ to 12 inches long, which had never laid eggs; but in 8 of them the ovaries were nearly ripe. Of the 17 immature, 6 were $10\frac{1}{2}$ inches or over in length, and in most cases the ovaries would not have become mature for two years." Of the 2,602 egg-bearing lobsters collected by the "Egret" during the season of 1905, from May 1 to December 1, only 129 measured less than $10\frac{1}{2}$ inches; 161 measured exactly $10\frac{1}{2}$ inches, 25 measured $10\frac{1}{4}$ inches, 63 measured 10 inches, 16 measured $9\frac{3}{4}$ inches, 16 measured $9\frac{1}{2}$ inches, 3 measured $9\frac{1}{4}$ inches and 6 measured 9 inches.

From the data which the writer has secured by personal observation from Rhode Island to Newfoundland, there are in the ocean, for every lobster $10\frac{1}{2}$ inches and over, from 3 to 6 lobsters 9 to $10\frac{1}{2}$ inches. The number varies in different localities. The aggregate weight of the average 100 lobsters $10\frac{1}{2}$ inches and over, as they come to the Boston market, varies between 160 and 170 pounds.¹

The aggregate weight of 100 lobsters from 9 to $10\frac{1}{2}$ inches is about 105 pounds (weights taken from individuals actually weighed and measured). I found that it required 155 9-inch lobsters to weigh as much as 100 of the average size in the Boston market. One hundred and fifty-five 9-inch lobsters can be expected to lay 190,000 eggs within a year, assuming that one-half of the number are females, and that one-half of these have reached the period of egg-laying and average 5,000 eggs

¹ One thousand and ten lobsters from entire original packages, chosen to fairly represent a typical shipment from Nova Scotia, comprised 563 11 inches or less, or 56.3 per cent., and 437 over 11 inches, or 43.7 per cent.; of these latter, 262 were between 11 and 12 inches, 151 were between 12 and 13 inches, 25 were between 13 and 14 inches and 9 were 14 inches. The largest was $14\frac{3}{8}$ inches, the smallest was 10 inches; of the 1,000, 35 were below the legal limit of $10\frac{1}{2}$ inches. These were selected from probably upwards of 6,000 lobsters. Of the remaining 5,000, many of those above 9 inches were shipped to Rhode Island and New York; the balance were canned, or consumed in Nova Scotia.

each; 100 lobsters above $10\frac{1}{2}$ inches similarly can be expected to lay 1,000,000 eggs within a year, assuming that 50 of them are females, and each of these yields 20,000 eggs.

While, commercially, the larger size ($10\frac{1}{2}$ -inch) is worth 55 per cent. more than the smaller one (9-inch), biologically, *i.e.*, in its egg-laying capacity, the larger size is more than 500 per cent. more valuable for increasing the lobster supply.

*All this goes to prove that the lobsters above $10\frac{1}{2}$ inches are most valuable for egg producers, and that to increase the reproductive capacity of the race the larger lobsters (*i.e.*, above $10\frac{1}{2}$ inches) must be protected by law.* What sane breeder, working for the improvement of a race of domesticated animals, would kill as many as possible of the best breeders, and depend upon the progeny of the youngest stock to improve or even maintain the standard? Yet such is the effect of the present lobster law.

Legislation should adequately protect the Lobster from its Enemies. — The other main point is the method of securing adequate protection from enemies. The former wonderful abundance of the lobster on our shores proves that, so far as natural enemies are concerned, the lobster is not only well able to maintain itself, but probably also to increase in numbers. It appears to be its own worst natural enemy, as its cannibalistic proclivities are notorious, though probably not operative to a very large extent except when confined in too restricted quarters. So long as the ordinary number of individuals (mainly immature) were killed by their natural enemies, such as dog-fish and other sharks, cod, bass, etc., no disastrous consequences were evident. But how disastrous and alarming have been the results of the onslaught by man, chiefly upon the mature individuals, under the direction of the present laws, which have no common-sense foundation, and no parallel or precedent in dealing with animals of similar habits, as an excuse for remaining on the statutes!

The present law, fixing the legal size at $10\frac{1}{2}$ inches, had its origin in a complete misconception, due to a lack of biological experience. It was argued that if lobsters as small as 8 inches were taken, many lobsters would be killed without having had a chance to reproduce a single litter of eggs; whereas, if none were killed less than $10\frac{1}{2}$ inches long, the majority would have

laid at least one litter of eggs. Since 1873, when this law originated, our biological experience has widened. Thinking people now wonder that the error could have been committed of expecting beneficial results from any law the tendency of which is to reduce the reproductive capacity of the animal, first, through the destruction of those adults which laid the most eggs, and, second, by a tendency to limit the breeding to immature animals. The law was copied by successive States, until laws practically identical in the primary features are in force throughout the lobster-producing States.

A further severe arraignment of the present law is its inherent difficulty of enforcement. This difficulty is not peculiar to conditions in Massachusetts, — it is the same from New York to Newfoundland (compare p. 192).

There appear but two worse laws than that of Massachusetts, and the difference is only one of degree, not of kind. Two States permit the capture and sale of 9-inch lobsters, and in some sections of the Maritime Provinces 8 inches is the legal length. Under the leadership of those who for their own selfish gain would strive to annihilate the last lobster, the attempt is made annually, under various covert pretexts, to foist upon the depleted industry a straight 9-inch law, thus for a brief present gain increasing the burden under which the industry is gradually sinking. To offset such efforts, however, earnest and honest good sense has thus far successfully prevailed. There is expressed on every side a sincere desire to ascertain the proper method of checking the depletion of the lobster supply, and immediately applying the remedy.

A Close Season, — Advantages and Objections. — Of the various propositions, the one most seriously considered is that of a close season, either for a term of years or for a portion of each year. A close season for a term of years would be of great advantage to the lobsters, and without question would bring about an increase in the number of lobsters in the ocean; but, as has been indicated above, the period, to be of any value commensurate with the loss which would be entailed to vested interests, must be for at least five years; and even then, if the present laws permitting the killing of adults should again go into force, the results of the five years' close season may dis-

appear in a single season of fishing. Unless the close season extending through a term of years is supplemented by a law which removes the cause of the depletion, the lobster supply is merely made intermittent, instead of perennial and perpetual. There must follow a consequent demoralization of the market, and an economic waste. In the opinion of those who have given the problem the most study, the lobster fisheries can by proper measures be made an abundant and permanent source of wealth to the fishermen and dealers, and a continuously available delicacy for man for an indefinite period of time.

A close season for a portion of the year is usually the first resort. It is based upon the argument that, inasmuch as a decline is caused by the killing of too many individuals, a close season must tend to restrict the number killed; and if the killing is entirely prohibited during the breeding season, the number of young which may be produced is likely to be increased. A close season may bring very manifest and satisfactory results in cases when the animal is a rapid breeder, or where the young reach maturity in a short time, say within one year, as birds. But it is by no means safe to argue that therefore a close season is equally applicable for checking the numerical decline of every or any particular animal. This is notably true of the lobster. A close season must fail to bring the expected results, for the reason that the lobster is a slow breeder, ordinarily laying eggs but once in two years, and carrying these eggs, attached to the modified legs under the abdomen, for ten or eleven months after laying; while the young require probably from four to seven years to reach maturity, and to attain a length of 7 to 10 inches.

Since the lobster breeds but once in *two* years, and carries the eggs from ten to eleven months after laying, it manifestly can make no difference to the race whether the young are destroyed as unlaidd eggs, as eggs recently laid, or as eggs just on the eve of hatching. The chief value of the close season to the lobster is that fewer lobsters may be caught; but the lobstermen and the public bear the burden, while the lobster does not get a commensurate benefit.

Even in Massachusetts there may be practical difficulties in deciding upon a date for beginning and ending the close sea-

son, on account of the various opinions as to how long such a close season should be, and from the fact that the lobster catching begins south of Cape Cod earlier in the spring than it does on the north shore. This ground for discord increases somewhat if the regions for which uniform laws are necessary are as far separated as New York and Newfoundland.

A further defect of a close season during a portion of the year is the fact that the lobster is especially convenient and satisfactory for human food during the warm season, which is the period of hatching (May 15 to July 25) and the period of egg laying (August to October).

Finally, the fundamental defect of a close-season law is that it restricts the demand, but does not adequately and economically increase the supply. The aim of sound economic legislation should be to increase the supply, without limiting the demand. In general, laws prescribing close seasons, restrictions in times and methods of catching, prohibition of canning or otherwise limiting the demand, should be the last resort, and then only after it has been found that efforts to increase the supply are futile.

Aside from the practical difficulties of securing a close season throughout the lobster range, and enforcing the laws, the value of the close season to the lobster as a race is commensurate with the duration of this close season. The longer it extends, the better for the lobster, but the worse for man. The burden upon investments in the lobster fisheries is increased. The absence of the lobster from the human food supply is felt by the public. Yet all this is of little avail, for the effects of the close season are not permanent, — the causes of the decline have not been removed. The lobsters, through a close season, either from one to six months each year or for a continued series of years, may have a chance to "catch up," only to be themselves "caught up" with redoubled energy, resulting in a glutted market and consequent economic waste for a time, with the certainty of a rapid return to the former conditions which made a close season necessary.

The grave objection to the present laws, namely, the practical difficulties in the way of enforcement, is also present in the case of a close season for catching, unless the law carries with it the prohibition of possession or sale during that close season both

for lobsters caught in Massachusetts and in other waters. The utter impracticability of securing close seasons for a uniform period from New York to Newfoundland, is a further objection to be considered.

Results under the Present 10½-Inch Law.—The 10½-inch law was fixed at this definite point in the belief that, by the time the lobster reached 10½ inches, practically all the individuals had laid at least one litter of eggs; and it was fixed at the 10½-inch point in the hope and expectation that, on account of the seemingly inexhaustible numbers, one litter of eggs would be sufficient to maintain a supply. Later experience has brought into relief the fact that nature has secured the continuance of the lobster supply by fixing the number of eggs at not far from 500,000 to each pair of lobsters. It was a serious biological error to believe that a reproductive capacity of 5,000 or 10,000 eggs could be expected to furnish as many lobsters as there would be if lobsters were permitted to produce the full number of eggs which nature demands for maintaining the species, viz., 500,000. *Therefore, it is obvious that the lobster must be given greater opportunity to breed, and as many adult individuals must be saved as possible, in order that the supply may not become commercially extinct. In other words, we must furnish the lobster additional length of time for breeding, so that the adults, instead of being exposed to capture as soon as they have produced say 15,000 eggs, should be protected for the purpose of enabling them to produce the full life quota of approximately 500,000 eggs.* Under the present laws we put a premium upon the catching of the adults of breeding age, whereas some law should be devised which will protect these adults.

Under the present laws, the number of adult breeding females has steadily and rapidly decreased. Reference to the following figures, compiled from the annual reports, indicates the startling magnitude of this decline:—

YEAR.	Total Number of Lobsters caught.	Number of Egg-bearing Lobsters caught.	Or One Egg-bearing Lobster to every —
1890,	1,612,129	90,909	22.8
1905,	426,471	9,865	42.1

The average female lobster in Massachusetts waters produced in 1905 15,670 eggs, according to the computations made from 1,311 specimens by Supt. C. G. Corliss at the Gloucester hatchery. This indicates a decline of at least 50 per cent. from the natural average yield per individual female.

The other line of action, namely, that of purchasing egg-bearing females from the fishermen and dealers (who, by keeping the lobsters in confinement in pounds, have discovered an additional source of profit from the sale of such lobsters as chance to lay a litter of eggs while in the pound), and either permitting the eggs to hatch while still attached to the swimmerets of the mother, or liberating the egg-bearing mother at the close of the open season for catching, approximates more closely to the correct and necessary method, namely, the protection of the breeders.

Proposed New Law. — In the opinion of the writer, — and the opinion is supported by many competent authorities (see p. 210), — if we would adequately protect all adult lobsters above $10\frac{1}{2}$ inches we could safely permit the legal capture of those between 9 and $10\frac{1}{2}$ inches. Such a measure presents no similarity to the ordinary 9-inch law, *i.e.*, which permits the capture of *all* lobsters above 9 inches; but it combines the advantages of such a 9-inch law with the benefits of a close season law for an extended period, *i.e.*, it permits the catching of lobsters above 9 inches, which are of least value in maintaining the species, and puts a close season upon those above $10\frac{1}{2}$ inches, which lay the greatest number of eggs, and eggs of the best quality for producing the strongest progeny. The ordinary 9-inch law, permitting the catching of everything above 9 inches, would be calamitous to the lobster industry. The public owes a debt of gratitude to the officials and members of the Massachusetts Fish and Game Protective Association, who have actively opposed such a 9-inch law at the public hearings and elsewhere.

The present suggestion, however, is entirely different, since it provides for a close season upon the adult and upon the smallest lobsters, permitting the catching only of those between 9 and $10\frac{1}{2}$ inches. The present chairman of the commission in 1902 made an investigation of the question, at the instance of His Excellency Governor Crane and Captain Collins, then chairman

of this commission. His report in no way covered the question of the expediency of such a change in the law; he merely called attention to the scientific basis of the law. As the present chairman of the commission, it is his duty to consider in addition the expediency of such legislation, and to call attention to the fact that such legislation is entirely untried, and is a theory, pure and simple. Nevertheless, it is a theory, or, rather, *a biological principle of action, which has been applied with success to whatever animals and plants man has found necessary or possible to domesticate; and has been proved to be an absolutely essential procedure, if we would maintain and increase the supply of such domesticated animals and plants.* It is, therefore, not entirely a new theory, but merely the application of an old theory to a new case. The results of such a law are not susceptible to proof until the evidence can be furnished by the actual observations upon the effects of such a law.

It is important, in a case like the present, to give greater attention to the objections to such a law than to the advantages. These objections appear to be at least five.

First of all, it is not uniform legislation throughout the lobster-producing States, and there is a possibility of working hardship to other States. For example: undoubtedly from Maine there would be a tendency to divert the 9-inch lobsters to the Boston market, and Maine would then be in the same position with reference to Massachusetts and the States south as is to-day Massachusetts in reference to the 9-inch laws in force in New York and Rhode Island. In addition to that, the States of Maine and the Canadian Provinces would be deprived of their market for large lobsters. This, however, should be an ultimate benefit, as more eggs would be laid, and therefore a larger number of marketable lobsters would develop from these eggs. Should Massachusetts and New York, the States where the most lobsters are marketed, pass the suggested law protecting the adults, and permitting the sale only of those lobsters between 9 and 10½ inches, the other States and Provinces would probably find it to their advantage to follow with similar laws.

Secondly, the law is on its face more difficult to enforce, because two measurements, the 9-inch as the lower limit and the 10½-inch as the upper limit, are necessary. The difficulty

of dealing with the upper limit can, however, be remedied by the use of a pot with a legal-sized ring (of such inside measurements as would prevent the entrance of lobsters above $10\frac{1}{2}$ inches), and an inspection and registration of the pot, instead of the inspection of the lobsters. Our observations upon the catches made by pots with various-sized rings follow. These figures cover the observations on experimental lobster pots with entrance rings of the sizes indicated, and show that a smaller number of large lobsters are caught in the smaller rings.

Largest Lobsters out of a Total of 325 caught in these Pots.

INSIDE DIAMETER OF ENTRANCE RING.	Length (Inches).	Diameter (Inches).	INSIDE DIAMETER OF ENTRANCE RING.	Length (Inches).	Diameter (Inches).
3-inch ring, . .	11	$2\frac{3}{4}$	$4\frac{1}{2}$ -inch ring, . .	$12\frac{1}{2}$	$3\frac{1}{8}$
$3\frac{1}{2}$ -inch ring, . .	$12\frac{1}{2}$	-		12	3
	12	3		12	3
	12	$3\frac{1}{4}$		12	3
4-inch ring, . .	$12\frac{1}{2}$	3		$12\frac{1}{2}$	$2\frac{7}{8}$
	12	$2\frac{7}{8}$		$12\frac{1}{2}$	$3\frac{1}{3}$
	$12\frac{1}{2}$	$3\frac{1}{8}$		12	$2\frac{7}{8}$
	12	3		12	$3\frac{3}{8}$
	12	$3\frac{1}{5}$		13	$3\frac{1}{2}$

A $3\frac{1}{2}$ -inch ring permitted the entrance of 20 lobsters $10\frac{1}{2}$ inches or over, out of a total catch of 56 lobsters, or 35.7 per cent.

Length (Inches).	Diameter (Inches).	Length (Inches).	Diameter (Inches).	Length (Inches).	Diameter (Inches).
$10\frac{3}{4}$	-	$10\frac{3}{4}$	$2\frac{1}{2}$	$10\frac{3}{4}$	$2\frac{3}{4}$
$12\frac{1}{2}$	-	11	$2\frac{5}{8}$	$11\frac{1}{2}$	$2\frac{3}{4}$
$11\frac{1}{4}$	-	$10\frac{3}{4}$	$2\frac{1}{4}$	11	$2\frac{7}{8}$
$11\frac{1}{4}$	-	11	$2\frac{3}{8}$	$11\frac{1}{4}$	$2\frac{3}{8}$
$11\frac{1}{2}$	$2\frac{1}{4}$	$10\frac{3}{4}$	$2\frac{1}{2}$	11	$2\frac{3}{4}$
$10\frac{3}{4}$	$2\frac{1}{2}$	12	3	12	$3\frac{1}{4}$
11	$2\frac{1}{4}$	$10\frac{3}{4}$	$2\frac{3}{4}$		

A 3-inch ring permitted the entrance of but 4 lobsters of $10\frac{1}{2}$ inches or over, out of a total catch of 37 lobsters, or only 10.8 per cent.

Length (Inches).	Diameter (Inches).	Length (Inches).	Diameter (Inches).
11	$2\frac{3}{4}$	11	$2\frac{1}{2}$
11	$2\frac{3}{8}$	$10\frac{1}{2}$	$2\frac{1}{2}$

The third objection is the injuries to vested interests, — to capital invested in the lobster business. It is a fact that such a bill, if it became a law, would reduce the average size of marketable lobsters six-tenths of one pound, and more lobsters would have to be handled by the lobster dealers for a given amount of money (in exact figures, 155 lobsters to every 100 lobsters under present conditions). Undoubtedly, too, the price per lobster paid by the dealers to the fishermen would be on the average correspondingly less than at present. On the other hand, the public demand and use a lobster as small as 9 inches, and the use of at least three times as many lobsters as under the present law would, in the opinion of the writer, do less damage to the future supply of lobsters than does the present destruction of lobsters above $10\frac{1}{2}$ inches.

A fourth objection is found in the fact that perhaps in at least two places in Massachusetts the large lobsters predominate in the catch, and therefore the present interests of the fishermen at these places might be injured. But it is not entirely certain that this injury would be actual, and from personal observations we are convinced that there are even at Cape Cod at least six lobsters between 9 and $10\frac{1}{2}$ inches to every one over $10\frac{1}{2}$ inches.

A fifth and most important query is, will enough lobsters escape the critical period of 9 to $10\frac{1}{2}$ inches and pass into the exempt class, where they can be sure of an extended period of egg-producing usefulness? This is entirely problematical, and there is at present absolutely no knowledge bearing upon the case. It is a fair presumption that enough would so escape. In any event, the lobster would have, under the proposed con-

ditions, — exemption from capture after reaching the point of $10\frac{1}{2}$ inches, — far greater opportunity to lay a larger number of eggs than under existing conditions, since under the present laws not only every lobster above $10\frac{1}{2}$ inches is exposed to capture, but, as a matter of fact, a greater number of those between 9 and $10\frac{1}{2}$ inches or even smaller are captured, in spite of all the machinery of law-enforcement which can be brought forward. The fact that lobsters on the average increase 15.6 per cent. at a moult is of importance. Thus, a 9-inch lobster would become $10\frac{1}{2}$ inches in one moult, and a $9\frac{1}{2}$ -inch lobster would become 11 inches, and thus exempt. Many individuals would pass within a few days entirely beyond the legal size for capture; and the actual length of time which a lobster requires to pass through the dangerous period of adult life (*i.e.*, from 9 to $10\frac{1}{2}$ inches, the only period when exposed to legal capture by man) may be, after all, relatively brief for any one lobster. Yet there should be such a number of individuals as to satisfactorily supply the market.

Our experience with the present laws dates from 1873. Since that time, even with the protection of a certain number of adults by purchase of egg-bearing lobsters and the hatching of eggs by the United States Bureau of Fisheries, and in spite of the fact that the $10\frac{1}{2}$ -inch limit was fixed at a point where the lobster had an opportunity to produce at least one litter of eggs, there has been a gradual decline in the catch of lobsters in Massachusetts from 84 per pot in 1891 to 26 per pot in 1904. The present laws are difficult to enforce: first, the public demand for 9 to $10\frac{1}{2}$ inch lobsters is strong; second, it is easy to destroy the evidence that a lobster was below the legal limit of size; third, the law is easily evaded (as described on p. 184), and therefore tempting; fourth, it is not practicable to properly safeguard the law-abiding fishermen. Honorable men throw overboard the short lobsters from their traps, and see these caught the next day by unscrupulous neighbors.

In the opinion of this commission, the lobster is approaching commercial extinction. In the neighborhood of the great markets, *i.e.*, in the waters of Connecticut, Rhode Island and Massachusetts, the decrease is especially evident; yet the biological conditions and the productive capacity of the range still re-

main essentially the same as they did when these same waters produced at least ten times the number of lobsters that they do to-day. Under wise laws, these waters might again produce as many lobsters as they did twenty or more years ago; but, in order to produce again the requisite number of lobsters to meet the demand, not only must there be protection for *all* the adults of breeding age, but active measures must be taken for placing the artificial lobster industry upon a commercial basis, when the value of the number of young lobsters produced will be in dollars and cents greater than the actual cost of production. The trout, shad and oyster industries have reached that stage. The lobster industry at present has not; but the outlook is promising, and appears to lie through the protection of the breeders, supplemented by protection of the just-hatched young up to such a stage as they are able to care for themselves on the bottom of the ocean, either after the methods developed by Bumpus and Mead in Rhode Island, or by the method of specially protected breeding reserves or nurseries for the young; and on this your commission hopes to have something to report next year.

In conclusion, we may say that for the interests of the Commonwealth and of the lobster a new law, restricting catching to those lobsters between 9 and 10½ inches, and putting a close season upon both males and females above 10½ inches, is without doubt a step far in advance. It is not a departure so radical as it appears to the popular mind at first glance. The close-season law has many obvious advantages, and the protection of the adult lobster is already in practical operation to a limited extent. The proposed measure is a combination of the two, and, though essentially a compromise measure, it embodies the advantages of both laws, with the disadvantages of neither.

Finally, such a law as would permit the legal catching and marketing of any lobster between 9 and 10½ inches, except those with eggs attached, would readily meet the market conditions in all the States and the Maritime Provinces. It would permit fishing to be carried on at all seasons, for the close season would then be upon only *a part of the lobsters all the year*, instead of upon *all the lobsters for a part of the year*.

During the past four years this modification of the law has

been carefully considered, and now numbers among its adherents many persons whose intelligence is unswayed by personal considerations, since they are interested in the lobster neither as fishermen nor dealers, and whose opinion is, therefore, of greatest weight.

The opinions given on the pages which follow have been expressed by prominent scientists, who are active students of marine biological questions:—

The killing of the breeding animals is the most rapid and certain method of reducing the numbers of undesirable animals. This has long been known in the case of land animals.

Prof. E. E. Prince, F.R.S., Commissioner of Fisheries of the Dominion of Canada, thus calls attention to the value of such practice when it is desirable to use the most effective method to diminish the number of fish of little value, *e.g.*, suckers, perch, pike, etc. (“Methods of Coarse Fish Extermination,” Sessional Paper No. 22, 1904, p. lxxiv.) If it were actually desired to exterminate the lobster, what more effective method could be used than the present practice of catching the adults?

I have long held the belief that our protection of lobsters was ineffectual, on account of its allowing the large lobsters, upon which we depend for keeping up the stock, to be destroyed. They are the sole source by which the species is to be maintained. In all similar cases we are coming to learn from our studies of fish and game that a large number of eggs and young are produced to maintain the numbers of the species.

The greatest fatality in most species occurs during the period from the egg to maturity. Most biological enemies surround the species in its immature stages. Man often strikes the adults of a species upon which it depends for maintenance, and in that way, before he knows it, has worked extermination.

We should revise our measures of protection distinctly, so as to include the breeding members of the species; and we should take our food-supply fishes and lobsters and practically all game species from the immature stages, before they have arrived at the important breeding stage. For that reason I should advocate the taking of lobsters only under 10½ inches or between the lengths of 9 and 10½ inches, for at least a term of years. (C. F. HODGE.)

The following letter was received from Prof. Sidney I. Smith of Yale:—

NEW HAVEN, CONN., Jan. 19, 1906.

MY DEAR DR. FIELD:—Your proposition to protect the larger instead of the smaller lobsters appears to me by far the best method yet suggested for the preservation of the fishery on our coast. Between thirty and forty years ago, when lobsters were still abundant, I believe that less than 1 per cent. of the young were produced by individuals under $10\frac{1}{2}$ inches in length, and I presume that this may be true at the present time. Even if the protection of the small individuals was fully enforced, it would, I believe, have comparatively little effect in preserving the supply of young, while the protection of the larger individuals would insure such a supply.

Very truly yours,

SIDNEY I. SMITH.

WILLIAMS COLLEGE, WILLIAMSTOWN, MASS., Feb. 6, 1906.

DR. GEO. W. FIELD, *Chairman, Commission on Fisheries and Game.*

DEAR SIR:—Will you allow me to say that the proposed recommendation to alter the existing lobster laws of the State of Massachusetts seems to me to be very wise, in view of their failures in this State, as well as the failure of the laws of other New England States and those of New York, to prevent a marked decline in the lobster supply.

Concerning new legislation, I do not believe in completely restricting production for a part of a year or for a term of years by a close season. I have argued against it in the case of the soft clam. One New England State has a close season of several months on the soft clam. It has not in any way prevented the falling off of the supply, so far as my observation goes.

As breeding in lobsters is so slow a process, and as the production of eggs increases so enormously with age in the female, I believe that the proposed amendment of the law, to protect lobsters *more* than $10\frac{1}{2}$ inches long, allowing the capture and sale of those less than that length, would be the wisest measure that could be proposed.

Very truly yours,

JAMES L. KELLOGG,

*Professor of Biology, Williams College.*DARTMOUTH COLLEGE, BIOLOGICAL DEPARTMENT,
HANOVER, N. H., Feb. 8, 1906.

MY DEAR PROFESSOR FIELD:—I have read your report, with its recommendations for changes in the laws controlling the lobster industry, with very great interest.

I believe you have worked out a plan for legislation based on thoroughly sound biological principles. Your plan appears to me *simple* and *practical*, easy to *enforce* by trap inspection and control. *very flexible*, so that, without changing the principles on which it is based, it will be possible, as experience may dictate, to raise or lower the dimensions and age of the protected sizes by regulating trap construction; and, finally, it promises, in my opinion, to effectually check the rapid decline in the number of lobsters without hardship to either the producer or the consumer.

I wish you every success in your efforts.

Yours very truly,

WILLIAM PATTEN.

Professor of Zoölogy.

The following statement is made by Dr. F. H. Herrick, who is the well-known special investigator for the United States Bureau of Fisheries, upon the lobster and the lobster industry:—

In restricting the size of marketable lobsters, the Atlantic coast States have adopted, and tried to enforce, a method which may be accurately described as (1) partial protection of the young and adult, with emphasis on the *young*, the aim being apparently to allow the adult to breed at least once before it is sacrificed. This, however, is not always done, since, as I have demonstrated elsewhere, the period of maturity is commonly delayed until after the 9-inch stage, and may even be deferred until the animal is over 11 inches long. This method, which has been given more than a fair trial, has proved sadly lacking.

We cannot speak of protection for the young alone as a *method* in this sense at all, for to destroy all adults indiscriminately is to wipe out the egg producers, and with them the race.

Protection of the adult alone in a strict sense is not practicable, because, as we have just seen, the period of maturity fluctuates between wide limit (8 to nearly 12 inches), and because the market must be supplied with animals of fair size.

The method which may be described as (2) partial protection of the adult and young, with emphasis on the *adult*, was first proposed by Dr. George W. Field in 1901. He advocated a change of the existing policy of protecting chiefly the young lobster, by placing the weight of restrictive laws upon the adult animal above a certain size, as 10 to 11 inches, when it is becoming most prolific, and therefore most valuable for the fishery. He would protect also the young up to the length of 8 or 9 inches; so that it would be permissible to capture adolescents and adults of all lengths between 8 and 10 inches, or between 9 and 10½ or 11 inches, while at either end would stand a permanently protected class of adults and young. Such a method has all the weight of biological fact and sound common sense on its side.

I formerly advocated the retention of the 10½-inch law, and opposed any reduction of this standard, because under the present method (see No. 1 above) this would cut out almost every trace of protection afforded adult animals, the present laws being designed, as already stated, to permit the lobster to breed at least once during its lifetime. On the other hand, I am heartily in favor of reducing the legal size-limit of marketable lobsters to 9 inches, *provided the larger adults are placed in a permanently protected class*.

To apply the principle of preserving the larger, breeding adults, I should favor fixing the limits of length between which it would be legal to sell or destroy lobsters at 8 to 10 inches, permanently protecting all animals above and all below these sizes. It might be an easier step from present conditions to set these limits between the 9 and 10½ inch stages, as I am informed by Dr. Field is the plan favored by the Department of Fisheries and Game in Massachusetts. This is not a vital matter, so long as the principle of protecting the adult is main-

tained; and this is best done by placing the bar close to the average period of sexual maturity, or approximately at the 10 or 10½ inch length.

Upon general principles, I should further retain the law prohibiting the destruction of berried female lobsters, however easily such a law may be evaded by the unconscientious fisherman.

FRANCIS H. HERRICK.

The arguments, evidence and testimony seem to prove that a change in the law, so as to make it legal to catch, possess and sell only such lobsters as are above 9 inches and not over 10½ inches, would be of advantage to the consumers, fishermen and dealers, by providing an abundant supply of lobsters throughout the year.

The Proposed Law combines Close Season and 9-Inch Law. — It would combine the best points of a close season (by putting a close season on all lobsters above 10½ inches and below 9 inches) and of a straight 9-inch law (by permitting the legal sale of lobsters between 9 and 10½ inches, size-limits which include the largest number of lobsters now caught).

Would be more readily and economically enforced. — By forbidding the use of any pot other than a legal, standard pot, with the seal of the inspector, having an entrance ring not exceeding 3 or 3¼ inches, the law could be more readily and economically enforced, since no large lobster could enter the pot, and the further possession of large lobsters would be illegal. The lower limit could be controlled by the prohibition of the use of lobsters under 8 inches as bait, or of their possession for any other purpose whatever. The temptation to keep an 8-inch lobster would be less than that involved in the possession of a large lobster.

Would increase the Number of Eggs produced. — It would immensely increase the number of eggs produced, and therefore the number of young lobsters which would by growth meet the market demand.

Would improve the Quality of Eggs produced. — By perpetually reserving the best specimens of mature age as a breeding stock, the best quality of young would be produced.

Objections. — The chief objections appear to be the difficulty of enforcement, on account of an upper and a lower limit of

size (it should be noted that the upper limit can be cared for by an entrance ring of a specified size upon the pots or traps), and the danger that too many small lobsters would be caught.

But the crux of the whole matter is that the present laws result in a diminished yield of eggs, and to this is to be ascribed the obvious and alarming decline of the lobster in all waters where the effects of these pernicious laws have become evident; and we therefore urge upon you a most careful, judicial and prompt consideration of this important question.

APPENDICES.

[A.]

LIST OF COMMISSIONERS.

UNITED STATES BUREAU OF FISHERIES, WASHINGTON, D. C.

George M. Bowers, Commissioner.

Hugh M. Smith, Deputy Commissioner.

Irving H. Dunlap, Chief Clerk.

John W. Titcomb, Assistant in charge of Division of Fish Culture.

Barton W. Everman, Assistant in charge of Division of Inquiry Respecting Food Fishes.

A. B. Alexander, Assistant in charge of Division of Statistics and Methods.

W. P. Titcomb, Disbursing Agent.

Hector von Bayer, Architect and Engineer.

Superintendents of United States Fisheries Stations.

E. E. Race, Green Lake, Me.

Charles G. Atkins, Craig Brook, East Orland, Me.

W. F. Hubbard, Nashua, N. H.

E. N. Carter, St. Johnsbury, Vt.

C. G. Corliss, Gloucester, Mass.

E. F. Locke, Woods Hole, Mass.

Livingston Stone, Cape Vincent, N. Y.

J. N. Wizner, Havre de Grace, Md.

L. G. Harron, Bryan Point, Md.

C. K. Green, Fish Lakes, Washington, D. C.

George A. Seagle, Wytheville, Va.

R. K. Robinson, White Sulphur Springs, W. Va.

Alexander Jones, Erwin Fishery, Tenn.

J. J. Stranahan, Cold Springs, Bullochville, Ga.

C. P. Henkel, Tupelo, Miss.

S. G. Worth, Edenton, N. C.

S. W. Downing, Put-in-Bay, O.

Frank N. Clark, Northville, Mich.

S. P. Wires, Duluth, Minn.

S. P. Bartlett, Quincy, Ill.

R. S. Johnson, Manchester, Ia.

H. D. Dean, Neosho, Mo.

J. L. Leary, San Marcos, Tex.

W. T. Thompson, Leadville, Col.

D. C. Booth, Spearfish, S. D.

James A. Henshall, Bozeman, Mont.

G. H. Lambson, Baird, Cal.

Claudius Wallich, Clackamas, Ore.

Henry O'Malley, Baker Lake, Wash.

ARIZONA.

Fish and Game.

T. S. Bunch,	Safford.
W. L. Pinney,	Phoenix.
Jean Allison,	Jerome.

CALIFORNIA.

W. W. Van Arsdale, President,	San Francisco.
W. E. Gerber,	Sacramento.
John Birmingham, Jr.,	Pinole.
Charles A. Vogelsang, Chief Deputy,	San Francisco.

COLORADO.

J. M. Woodard,	Denver.
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CONNECTICUT.

George T. Mathewson, President,	Thompsonville.
E. Hart Geer, Secretary,	Hadlyme.
Robert G. Pike,	Middleton.

DELAWARE.

A. D. Poole, President,	Wilmington.
J. D. Bush, Secretary and Treasurer,	Wilmington.

FLORIDA.

Honorary Fish and Game Commissioner.

John Y. Detwiler,	New Smyrna.
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GEORGIA.

A. T. Dallis,	La Grange.
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IDAHO.

William N. Stephens,	Rexburg.
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ILLINOIS.

State Game Commissioner.

John A. Wheeler,	Springfield.
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Board of Fish Commissioners.

Nat H. Cohen, President,	Urbana.
S. P. Bartlett, Superintendent,	Quincy.
August Lenke, Treasurer,	Chicago.

INDIANA.

Z. T. Sweeney, Columbus.
 E. E. Earle, Chief Deputy, Indianapolis.

IOWA.

Fish and Game Warden.

George A. Lincoln, Cedar Rapids.

KANSAS.

D. W. Travis, Pratt.

MAINE.

Inland Fisheries and Game.

L. T. Carleton, Chairman, Winthrop.
 J. W. Brackett, Phillips.
 Edgar E. Ring, Orono.

Sea and Shore Fisheries.

A. R. Nickerson, Boothbay Harbor.

MARYLAND.

Fisheries Commissioners.

James D. Anderson, Somerset County.
 Charles F. Brook, Montgomery County.

State Game and Fish Warden.

Col. John W. Avirett, Cumberland.

Assistant Warden.

Oregon Milton Dennis, Baltimore.

MASSACHUSETTS.

George W. Field, Chairman, Sharon.
 Edward A. Brackett, Winchester.
 John W. Delano, Marion.

Office, State House, Boston.

MICHIGAN.

Fish Commissioners.

Freeman B. Dickerson, Detroit.
 George M. Brown, Saginaw.
 Charles D. Joselyn, Detroit.

Game and Fish Warden.

Hon. Charles H. Chapman, Sault Ste. Marie.

MINNESOTA.

Uri L. Lamprey, President, St. Paul.
 H. G. Smith, First Vice-President, Minneapolis.
 O. J. Johnson, Second Vice-President, Glenwood.
 D. W. Meeker, Secretary, Moorehead
 S. F. Fullerton, Executive Agent, St. Paul.

MISSOURI.

Joseph H. Rodes, Sedalia.

MONTANA.

State Game and Fish Warden.

William F. Scott, Helena.

NEBRASKA.

Gov. John H. Mickey, Lincoln.
 George L. Carter, Chief Deputy, Lincoln.

NEW HAMPSHIRE.

Nathaniel Wentworth, Chairman, Hudson Centre.
 Charles B. Clarke, Financial Agent, Concord.
 Merrill Shurtleff, Secretary, Lancaster.

NEW JERSEY.

Benj. P. Morris, President and Treasurer, Long Branch.
 Richard T. Miller, Camden.
 David P. McClellan, Morristown.
 Percy H. Johnson, Secretary, Bloomfield.

NEW MEXICO.

Page B. Otero, Santa Fé.

NEW YORK.

Forest, Fish and Game Commission.

James S. Whipple, Commissioner, Salamanca.
 J. Duncan Lawrence, Deputy Commissioner, Bloomville.
 John D. Whish, Secretary, Albany.

Shellfish Commissioner.

B. Frank Wood, New York.

NORTH DAKOTA.

District Game Warden.

F. W. Schlechter, District No. 1,	Fessenden.
William McKean, District No. 2,	Sanborn.

OHIO.

Commissioners of Fish and Game.

Paul North, President,	Cleveland.
Thomas B. Paxton,	Cincinnati.
J. F. Rankin,	South Charleston.
D. W. Greene,	Dayton.
George W. McCook,	Steubenville.
George C. Blankner, Secretary,	Columbus.
J. C. Porterfield, Chief Warden,	Columbus.

OKLAHOMA.

Territorial Game and Fish Warden.

Eugene Watrous,	Enid.
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OREGON.

Master Fish Warden.

H. G. Van Dusen,	Astoria.
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Game and Forestry Warden.

J. W. Baker,	Cottage Grove.
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PENNSYLVANIA.

Game Commissioners.

William M. Kennedy, President,	Pittsburg.
C. K. Sober,	Lewisburg.
James H. Worden,	Harrisburg.
William Heywood Myers,	Williamsport.
Charles B. Penrose,	Philadelphia.
Frank G. Harris,	Clearfield.
Dr. Joseph Kalbfus, Secretary,	Harrisburg.

Commissioner of Fisheries.

W. E. Meehan,	Harrisburg.
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Board of Fishery Commission.

John Hamberger,	Erie.
Henry C. Cox,	Wellsboro.
Andrew R. Whitaker,	Phoenixville.
W. A. Leisenring,	Mauch Chunk.

RHODE ISLAND.

Commissioner of Inland Fisheries.

Henry T. Root, President,	.	.	.	.	.	Providence.
William P. Morton, Secretary,	.	.	.	.	.	Johnston.
J. M. K. Southwick,	.	.	.	.	.	Newport.
Charles W. Willard,	.	.	.	.	.	Westerly.
Adelbert Roberts,	.	.	.	.	.	Woonsocket.
Albert Davis Mead,	.	.	.	.	.	Providence.
William H. Boardman,	.	.	.	.	.	Central Falls.

Commissioners of Shell Fisheries.

James M. Wright,	.	.	.	.	.	Foster.
Herbert M. Gardiner,	.	.	.	.	.	Barrington.
Philip H. Wilbour,	.	.	.	.	.	Little Compton.
George W. Hoxie,	.	.	.	.	.	Charlestown.
John H. Northup,	.	.	.	.	.	Warwick.
James C. Collins, Clerk,	.	.	.	.	.	North Providence.

Commissioners of Birds.

John H. Flanagan, Chairman,	.	.	.	.	.	Providence.
W. Gordon Reed, 2d,	.	.	.	.	.	Cowesett.
E. R. Lewis,	.	.	.	.	.	Westerly.
William H. Thayer,	Bristol.
A. O'D. Taylor,	Newport.

TENNESSEE.

State Warden.

Joseph H. Acklen,	Nashville.
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UTAH.

John Sharp,	Salt Lake City.
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VERMONT.

Henry G. Thomas,	Stowe.
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WASHINGTON.

T. R. Kershaw,	Bellingham.
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WEST VIRGINIA.

Game and Fish Warden.

James H. Marcum,	Huntington.
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WISCONSIN.

State Warden.

Henry Overbeck, Jr., Madison.

Commissioners of Fisheries.

The Governor, Ex Officio.

Calvert Spensley, President, Mineral Point.

Jas. J. Hogan, Vice-President, La Crosse.

E. A. Birge, Secretary, Madison.

William J. Starr, Eau Claire.

Henry D. Smith, Appleton.

Jabe Alford, Madison.

A. A. Dye, Madison.

James Nevin, Superintendent, Madison.

[B.]

DISTRIBUTION OF FOOD FISH.

BROOK TROUT.

Fry distributed from the Sutton Hatchery during April and May, 1905.

APPLICANT.	Name of Brook.	Town.	Number.
Alfred Read,	Barry,	Westfield,	5,000
Ward Rees,	Tekoa,	Westfield,	5,000
L. A. Pierce,	Smith,	Westfield,	5,000
George Bowers,	Root,	Westfield,	5,000
R. R. Andrews,	Ponders Hollow,	Westfield,	5,000
F. A. Pierce,	Sodom,	Westfield,	5,000
J. B. Hazelton,	Slab,	Westfield,	5,000
L. H. Bowers,	Kellogg,	Westfield,	5,000
Robert L. Soper,	Oak Orchard,	Westfield,	5,000
Wm. A. Soper,	Jacks,	Westfield,	5,000
W. J. Morton,	Cold Spring,	Westfield,	5,000
W. T. Thomas,	Hollister,	Westfield,	5,000
C. F. Cowdry,	Mulpus,	Lunenburg,	5,000
C. F. Cowdry,	Bixby,	Ashby,	5,000
C. A. Hunter,	Robins,	Concord,	5,000
L. N. Fowler,	Heyward's,	Concord,	5,000
John A. Buguey,	Harrington's,	Concord,	5,000
Thomas Curry,	Sheehan,	Concord,	5,000
David L. Ball,	Angiers,	Concord,	5,000
Chas. B. Adams,	Brown and Potash,	Webster,	5,000
Chas. B. Adams,	Simpson,	Webster,	5,000
P. S. Callahan,	Bemis,	Sturbridge,	5,000
O. L. Howlett,	Marcy,	Holland,	5,000
E. E. Whiting,	Mechanic,	Upton,	5,000
L. F. Despeaux,	Mill,	Upton,	5,000
Patrick Shaughnessy, . . .	Bernard,	Upton,	5,000
E. C. Vinton,	Hudson,	Grafton,	5,000
F. A. Anderson,	Cold Spring,	Grafton,	5,000
George Pogue,	George,	Grafton,	5,000
Wm. Gillespie,	Axtell,	Grafton,	5,000
Horace H. Adams,	Adams,	Grafton,	5,000
Geo. E. Whitehead,	McCracken and Carters, . . .	Millbury,	5,000
Wm. L. Taft,	Poor Farm,	Northbridge,	5,000
Geo. L. Gill,	Carpenter,	Northbridge,	5,000
C. V. Dudley,	Prentice,	Northbridge,	5,000
W. E. Johnson,	Purgatory,	Northbridge,	5,000
A. S. Noyes,	Burt,	Northbridge,	5,000
Cyrus H. Mentzer,	Cold Harbor,	Northborough, . . .	5,000
Wm. A. Gaines,	Edgell's,	Framingham,	5,000
Arthur E. French,	Thayer,	Palmer,	5,000
C. L. Allen,	Barber,	Worcester,	5,000
H. A. Sharp,	Diamond,	Norfolk,	5,000
Geo. B. Green,	Canoe River,	Mansfield,	5,000
E. L. Freeman,	Gurney,	Medway,	5,000
L. C. Humphrey,	Doggets,	Rochester,	5,000
G. F. Prevear,	McGovern's,	Leominster,	5,000
G. F. Prevear,	Lunenburg,	Leominster,	5,000
G. F. Prevear,	Fall,	Leominster,	5,000
G. F. Prevear,	Pottery,	Leominster,	5,000
G. F. Prevear,	Chauchit,	West Sterling,	5,000
Hobart Raymond,	-	-	5,000
Gilbert Flagg,	-	-	5,000
Chas. Grimes,	Cook,	Hubbardston,	5,000
E. A. Woodward,	Natty,	Hubbardston,	5,000

Fry distributed from the Sutton Hatchery, etc.—Concluded.

APPLICANT.	Name of Brook.	Town.	Number.
Alfred C. Murdock, . . .	Davis Meadow,	Hubbardston, . . .	5,000
L. H. Ruggles,	Moose,	Hardwick,	5,000
Jas. H. O'Hara,	Sheldon,	Deerfield,	5,000
Jas. H. O'Hara,	Old World,	Deerfield,	5,000
Jas. H. O'Hara,	Stickney,	Shelburne,	5,000
Patrick Shaughnessy, . . .	Bernard,	West Upton,	5,000
E. E. Whiting,	Mechanic,	West Upton,	5,000
L. F. Despeaux,	Mill,	West Upton,	5,000
			310,000

Fry distributed from the Adams Hatchery during April and May, 1905.

Joseph D. Fontaine, . . .	Punch and Simonds,	Greenfield, . . .	30,000
Joseph D. Fontaine, . . .	Cherry Run and Fisk,		
Joseph D. Fontaine, . . .	First Gorge and Second Gorge, . . .		
Chas. F. Jacobus,	Gill Schoolhouse and Dry,	Turner's Falls, . . .	5,000
N. P. Farwell,	Dry,	Gill,	5,000
Farwell Pfernicks,	Clark,	Buckland,	30,000
John L. Haigis,	Drake,	Buckland,	
Wm. H. Noonan,	Dragon,	Shelburne,	
W. G. Rotherham,	Apple Valley,	Shelburne,	30,000
J. S. Outhouse,	Avery,	Charlemont,	
James W. Wild,	Wilder,	Charlemont,	
Frank W. Rice,	Town and Wood,	Lanesborough, . . .	10,000
Geo. F. Sayles,	Dry,	Adams,	5,000
Geo. F. Sayles,	Bassett,	Adams,	5,000
Harry J. Sheldon,	Gordon,	Adams,	5,000
James H. Krum,	Tunnel,	North Adams, . . .	5,000
James H. Krum,	Hudson,	North Adams, . . .	5,000
James H. Krum,	Sherman,	North Adams, . . .	5,000
C. H. Sage,	- - - - -	Great Barrington, .	15,000
C. H. Sage,	- - - - -		
C. H. Sage,	- - - - -		
H. O. Hicks,	Cold River,	Adams,	5,000
L. B. Moore,	Slater,		
L. B. Moore,	Jerusalem,		
L. B. Moore,	Riverside,	Tryingham,	15,000
H. F. Barrett,	East Hoosac,		
B. H. Shaw,	Walker,		
E. L. Bird,	Hollis,	Windsor,	5,000
W. S. Hathaway,	Hathaway,	Windsor,	5,000
J. A. Morrison,	Cold,	Savoy,	5,000
John Z. Frizzell,	Fuller, Pierce and Trout,	Middlefield,	5,000
J. G. Bennett,	Pettibone,	Peru,	10,000
J. M. Burns,	Smith,	Cheshire,	5,000
J. M. Burns,	Shaker,	Pittsfield,	15,000
J. M. Burns,	Sackett,		
S. G. Tenney,	Idlewild,		
A. F. Ramage,	Dunbar,	Williamstown, . . .	10,000
		Monroe,	5,000
			215,000

Fry distributed from the Winchester Hatchery during April and May, 1905.

W. F. Davis,	Gallagher's,	Acton,	3,000
J. Sidney White,	Cole's,	Acton,	3,000
J. Sidney White,	Wills',	Acton,	3,000
Clifford Poor,	Pearl and tributaries,	Boxford,	3,000
Clifford Poor,	Pearl and tributaries,	Boxford,	3,000
Clifford Poor,	Pearl and tributaries,	Boxford,	3,000
Clifford Poor,	Pearl and tributaries,	Boxford,	3,000
Caleb L. Smith,	Golden Cove,	Chelmsford,	3,000
Wm. A. Lang,	Ambrose Hale,	Billerica,	3,000
Geo. W. Alcott,	Golden Cove,	Chelmsford,	3,000
F. A. Griffin,	Nashoba,	Westford,	3,000

Fry distributed from the Winchester Hatchery, etc. — Concluded.

APPLICANT.	Name of Brook.	Town.	Number.
Henry Boynton, . . .	Black, . . .	Lowell, . . .	3,000
Wm. E. Badger, . . .	Trull's and Hood's, . . .	Tewksbury, . . .	3,000
H. S. Cryslor, . . .	Crooked Spring, . . .	Chelmsford, . . .	3,000
Ernest N. Schofield, . . .	Argella and Mill, . . .	Groveland, . . .	6,000
Ernest N. Schofield, . . .	Grindle and Morrill's, . . .	Groveland, . . .	6,000
Chas. M. Kimball, . . .	Houghton's, . . .	South Acton, . . .	3,000
Chas. M. Kimball, . . .	Rocky, . . .	South Acton, . . .	3,000
Chas. M. Kimball, . . .	Cemetery, . . .	South Acton, . . .	3,000
Chas. M. Kimball, . . .	Taylor's, . . .	South Acton, . . .	3,000
Wm. Finucane, . . .	- . . .	Methuen, . . .	3,000
A. S. Mitchell, . . .	Brown's, . . .	Lexington, . . .	3,000
H. M. Monroe, . . .	Trout, . . .	Lexington, . . .	3,000
Edward S. Payson, . . .	Grassland, . . .	Lexington, . . .	3,000
O. W. Whittemore, . . .	Mill, . . .	Arlington, . . .	3,000
N. J. Hardy, . . .	Reed's, . . .	Arlington, . . .	3,000
Roswell Wetherbee, . . .	Ryan's, . . .	Lexington, . . .	3,000
M. E. S. Clemons, . . .	Causeway and Witham's, . . .	Andover, . . .	3,000
Joshua D. Upton, . . .	Willis, . . .	North Reading, . . .	3,000
John H. Sweetser, . . .	Hall's, . . .	Woburn, . . .	3,000
Wm. J. Hammond, . . .	Cutler's, . . .	Woburn, . . .	3,000
Chas. H. Buss, . . .	Lincoln, . . .	Woburn, . . .	3,000
Charlie A. Jones, . . .	Shaker Glen, . . .	Woburn, . . .	3,000
C. C. Taylor, . . .	Cutler's, . . .	Woburn, . . .	3,000
Frank W. Ames, . . .	McManus, . . .	Woburn, . . .	3,000
John T. Hill, . . .	Sandy, . . .	Woburn, . . .	3,000
Frank W. McIntosh, . . .	Fowle, . . .	Bedford, . . .	3,000
S. M. Hawey, . . .	Bennett, . . .	Burlington, . . .	3,000
Lewis A. White, . . .	Sandy, . . .	Burlington, . . .	3,000
Chas. E. Taylor, . . .	Walker's, . . .	Burlington, . . .	3,000
E. C. Farwell, . . .	Tributary Ipswich River, . . .	Reading, . . .	3,000
Arthur Roberts, . . .	Huckleberry, . . .	Reading, . . .	3,000
Geo. W. Lovell, . . .	Tan Yard, . . .	Middleborough, . . .	3,000
S. E. Bisbee, . . .	Bennett's, . . .	Middleborough, . . .	3,000
Willard Osborn, . . .	Green Bottom, . . .	Lakeville, . . .	3,000
John Moody, . . .	Clark's, . . .	Middleborough, . . .	3,000
Harry K. Perkins, . . .	Linus Snow, . . .	Bridgewater, . . .	3,000
Arthur J. Wallen, . . .	Ice House, . . .	Campello, . . .	3,000
John J. Kennedy, . . .	Dead Meadow, . . .	Stoughton, . . .	3,000
Walter H. Edgerly, . . .	Meadow, . . .	West Bridgewater, . . .	3,000
C. H. Leonard, . . .	Ford's, . . .	Middleborough, . . .	6,000
Seth Damon, . . .	Old Swamp River, . . .	Weymouth, . . .	3,000
Geo. L. Peabody, . . .	Plyer, . . .	Hanover, . . .	3,000
Geo. L. Peabody, . . .	Silver, . . .	Hanover, . . .	3,000
R. R. Freeman, . . .	Town Brook, . . .	Wellfleet, . . .	3,000
Maynard D. Orr, . . .	Wyne, . . .	Rockport, . . .	5,000
Murray J. Bowen, . . .	North branch Palmer's River, . . .	Rehoboth, . . .	3,000
George W. Field, . . .	Beaver Hole Brook, . . .	Sharon, . . .	5,000
Geo. F. Pearson, . . .	Marshall's, . . .	Lowell, . . .	3,000
			190,000

Fry distributed from the Hadley Hatchery during April and May, 1905.

F. M. Smith, . . .	Leaping Well, . . .	South Hadley, . . .	4,000
S. E. Bliss, . . .	Leaping Well, . . .	South Hadley, . . .	4,000
Geo. Hoffman, . . .	Buttery, . . .	South Hadley, . . .	4,000
B. C. Brainard, . . .	Buttery, . . .	South Hadley, . . .	4,000
F. E. White, . . .	Elmer, east branch, . . .	South Hadley, . . .	4,000
John Shields, . . .	Elmer, west branch, . . .	South Hadley, . . .	4,000
Charles H. Sawyer, . . .	Running Gutter, . . .	Hatfield, . . .	5,000
T. F. Ahern, . . .	Ahern Brook, . . .	Sunderland, . . .	5,000
Peter McHugh, . . .	Board, . . .	Northampton, . . .	5,000
Edward Miller, . . .	Robert's Meadow, . . .	Northampton, . . .	5,000
Louis Gaylor, . . .	Parsons, . . .	Northampton, . . .	5,000
Wm. H. Felker, . . .	Loudville, . . .	Westampton, . . .	5,000
Eli M. Converse, . . .	Pierces, . . .	West Brookfield, . . .	5,000
J. B. Haskins, . . .	Allen, . . .	West Brookfield, . . .	5,000
C. H. Clark, . . .	Kent Meadow, . . .	West Brookfield, . . .	5,000

Fry distributed from the Hadley Hatchery, etc.—Concluded.

APPLICANT.	Name of Brook.	Town.	Number.
C. E. Bill,	White,	West Brookfield, .	5,000
E. W. Lawton,	Elwell,	Ware,	5,000
M. C. Wood,	Sampson,	Ware,	5,000
M. W. Smith,	Hampshire,	Goshen,	5,000
F. E. Hawkes,	Rogers,	Goshen,	5,000
John Doherty,	Packard,	Goshen,	5,000
W. A. Smith,	Highland,	Goshen,	5,000
W. S. Gabb,	Nipping,	Cummington, . . .	5,000
W. S. Gabb,	Clark,	Cummington, . . .	5,000
W. S. Gabb,	Shaw,	Cummington, . . .	10,000
W. S. Gabb,	Mitchell,	Cummington, . . .	10,000
Henry L. Pierce, . . .	Paige,	Barre,	10,000
John S. Rice,	Tolman,	Barre,	5,000
Geo. R. Simonds, . . .	Prince,	Barre,	10,000
M. R. Goddard, . . .	Hubbardston,	Hubbardston, . . .	5,000
B. F. Pierce,	Hubbardston,	Hubbardston, . . .	5,000
Stewart K. Pierce, . .	Ragged Hill,	Hubbardston, . . .	5,000
Chas. A. Brown, . . .	Lovewell,	Hubbardston, . . .	5,000
H. L. Shepardson, . .	No name given, . . .	Phillipston, . . .	5,000
Chas. N. Dyer,	Conesto,	Hubbardston, . . .	5,000
Arthur W. Pratt, . . .	Bailey,	Gardner,	5,000
Edward L. Knowlton, .	Poor Farm,	Gardner,	5,000
C. E. Barron,	Moores,	Westminster, . . .	5,000
C. T. Mellen,	Bigelow Hill,	Westminster, . . .	5,000
J. W. Toner,	Coolidge,	Gardner,	5,000
A. H. Jefts,	Sanger,	Athol,	5,000
L. P. Hapgood,	Buckman,	Athol,	5,000
Ezra O. Bradford, . .	Ellinwood,	Athol,	5,000
N. P. Farwell,	Fall River,	Barnardston, . . .	10,000 ¹
Chas. F. Jacobus, . . .	Dry and Clark, . . .	Gill,	15,000 ¹
Harland M. King, . . .	Wheeler,	Athol,	4,000
Robert Brookhouse, Jr.,	Rice,	Athol,	4,000
M. B. Waterman, . . .	Sanger,	Athol,	4,000
A. G. Wesley,	Sweetwater or Wright,	Athol,	4,000
E. B. Newton,	Ellinwood,	Athol,	4,000
J. W. Jackson,	Gillard and Olds, . . .	Belchertown, . . .	5,000
			279,000

¹ These lots were brown trout.*Fingerling Brook Trout Plants.*

C. B. Sampson,	Broad,	Holyoke,	500
Arthur E. Fitch, . . .	Thayer,	Palmer,	500
H. D. Moulton,	Moulton and Creamery,	Monson,	500
Everett Flood,	Tributary to West Reservoir,	Monson,	500
Wm. H. Roberts <i>et al.</i> ,	Poor,	Chicopee Falls, . .	500
Alfred Read <i>et al.</i> ,	Powder Mill,	Westfield,	1,000
J. F. Barrett,	Tributary of Ware River,	Barre,	250
H. L. Pierce,	Tributary of Prince River,	Barre,	250
H. O. Elliott,	Willow,	Ashburnham, . . .	250
H. G. Howard,	Cooper,	Ashburnham, . . .	250
Walter Aiken,	Trout,	Templeton,	250
L. N. Hadley,	Trout,	Templeton,	250
John C. Dudley, . . .	Ellis,	Sutton,	250
J. E. Stuart,	Bigelow and Goodridge,	Westminster, . . .	500
C. L. Allen,	Barber's,	Worcester,	250
P. A. Dowd,	Weasel,	Worcester,	250
F. L. Hager,	Beaman's,	Winchendon, . . .	250
George Pogue <i>et al.</i> ,	Cold Spring,	Grafton,	500
F. S. Casavant <i>et al.</i> ,	Bailey,	Gardner,	1,000
E. A. Woodward, . . .	Tannery,	Hubbardston, . . .	500
C. E. Bill <i>et al.</i> ,	White,	West Brookfield, .	500
Chas. W. Eggleston, .	Mad,	North Brookfield, .	500
C. F. Cowdry <i>et al.</i> ,	Bixby,	Townsend,	500
C. F. Cowdry <i>et al.</i> ,	Mulpus,	Lunenburg,	500
H. W. Barnes <i>et al.</i> ,	Purgatory,	Northbridge, . . .	500
Charles B. Adams, . .	Potash,	Webster,	500
Geo. F. Prevear <i>et al.</i> ,	Tophet,	Shirley,	500

Fingerling Brook Trout Plants—Continued.

APPLICANT.	Name of Brook.	Town.	Number.
P. S. Callahan, . . .	Highland, . . .	Fiskdale, . . .	250
W. F. Knowlton, . . .	Bummit, . . .	Shrewsbury, . . .	500
A. D. Barnes, . . .	Hobbs, . . .	Sturbridge, . . .	250
James A. Holden, . . .	Ball, . . .	Holden, . . .	250
J. Frank Stone, . . .	Great, . . .	East Brookfield, . . .	250
Geo. W. Boutel <i>et al.</i> , . . .	Riceville, . . .	Athol, . . .	500
Chas. O. Flagg, . . .	Great Meadow, . . .	Hardwick, . . .	250
L. H. Ruggles, . . .	Moose, . . .	Hardwick, . . .	250
Leo Clarke, . . .	Fox, . . .	Millville, . . .	250
E. E. Whiting <i>et al.</i> , . . .	Mill and Mechanic, . . .	West Upton, . . .	500
H. C. Capen <i>et al.</i> , . . .	Howe, . . .	Spencer, . . .	500
Geo. E. Whitehead, . . .	Carter's and McCracken, . . .	Millbury, . . .	250
George S. Sayles, . . .	Gulf, . . .	Cheshire, . . .	250
F. N. Haskins, . . .	Haskins, . . .	Savoy, . . .	250
John Z. Frizzell, . . .	Tuttle, . . .	Peru, . . .	250
James M. Burns, . . .	Yokum and Shaker, . . .	Pittsfield, . . .	1,000
Frank W. Rice, . . .	Town, . . .	Lanesborough, . . .	500
Frank W. Rice, . . .	Northrup, . . .	Lanesborough, . . .	250
H. A. Barton, . . .	Barton, . . .	Dalton, . . .	250
F. N. Groesbeck, . . .	Brown, . . .	Dalton, . . .	250
P. J. Clark, . . .	Potash, . . .	Hinsdale, . . .	500
F. H. Pierce <i>et al.</i> , . . .	Pierce, . . .	Windsor, . . .	250
L. B. Moore, . . .	Branch of Hop Brook, . . .	Tyringham, . . .	250
H. O. Hicks <i>et al.</i> , . . .	Tophet, right branch, . . .	Adams, . . .	1,000
C. L. Crafts, . . .	Roaring, . . .	Whately, . . .	250
W. G. Rotherham <i>et al.</i> , . . .	Clesson's, . . .	Ashfield and Buck- land, . . .	1,000
Sigmond Klaiber <i>et al.</i> , . . .	Fall River, . . .	Gill, . . .	1,000
C. R. Hills, . . .	Fall River, . . .	Bernardston, . . .	250
Jas. H. O'Hara <i>et al.</i> , . . .	Glen, . . .	Leyden, . . .	1,000
A. S. Hunt <i>et al.</i> , . . .	Middle branch Swift River, . . .	Orange, . . .	1,000
W. M. Niles <i>et al.</i> , . . .	Rice, . . .	Charlemont, . . .	500
James Donoghue, . . .	Barker's, . . .	Methuen, . . .	500
Edwin J. Castle, . . .	Ward's, . . .	Andover, . . .	250
Ernest N. Schofield, . . .	Grindle, . . .	Groveland, . . .	750
Clifford Poor, . . .	Pearl, . . .	Boxford, . . .	500
T. L. Jenkins, . . .	Gallup's, . . .	Topsfield, . . .	250
Hiram A. Young, . . .	Mitchell, . . .	Beverly, . . .	250
Warren H. Beede, . . .	Outlet, . . .	Peabody, . . .	500
Moody Kimball, . . .	Tanhouse, . . .	Rowley, . . .	250
Oliver A. Bailey, . . .	Dow, . . .	Ipswich, . . .	250
F. T. Slater, . . .	Alewife, . . .	Gloucester, . . .	250
Walter H. Edgerly, . . .	Town Stream, . . .	West Bridgewater, . . .	250
Thomas W. Frost, . . .	Trout, . . .	Brockton, . . .	250
D. W. Wright, . . .	Holloway, . . .	Lakeville, . . .	250
Arthur J. Wallen, . . .	Ice-house, . . .	Campello, . . .	250
Geo. L. Peabody, . . .	Sliver and Plyer, . . .	Hanover, . . .	250
E. A. McMaster, . . .	Breck's, . . .	Bridgewater, . . .	250
S. E. Blsbee <i>et al.</i> , . . .	Alden, . . .	Middleborough, . . .	1,000
Edward N. Ames, . . .	Foster's Meadow, . . .	Wilmington, . . .	250
A. S. Mitchell <i>et al.</i> , . . .	Monroe's, . . .	Lexington, . . .	250
H. P. Anderson, . . .	Hog, . . .	Hudson, . . .	250
E. C. Farwell, . . .	Tributary to Ipswich River, . . .	Reading, . . .	250
F. B. Twitchell, . . .	Noanet, . . .	Dover, . . .	125
Chas. M. Kimball, . . .	Nagog, . . .	South Acton, . . .	1,000
Loring N. Fowler <i>et al.</i> , . . .	Second Division, . . .	Concord Junction, . . .	250
C. A. Hunter, . . .	Robins, . . .	Concord, . . .	250
F. I. Knight, . . .	Woods, . . .	Townsend, . . .	250
N. J. Hardy, . . .	Lock, . . .	Arlington, . . .	250
W. A. Kemp, . . .	Sucker, . . .	Pepperell, . . .	250
H. E. Hersam, . . .	Cemetery, . . .	Stoneham, . . .	250
A. Ward Follett, . . .	Ryan's, . . .	North Lexington, . . .	250
Chas. N. Hargraves, . . .	Baiting, . . .	Framingham, . . .	250
James Menzies, . . .	Swain's, . . .	North Chelmsford, . . .	375
Geo. F. Pearson, . . .	Marshall's, . . .	Lowell, . . .	375
C. M. Griffin, . . .	Vine, . . .	Westford, . . .	250
Joseph Rudolph, . . .	Hunting-house, . . .	Myricks, . . .	250
Murray J. Bowen, . . .	Branch of Palmer's River, . . .	Rehoboth, . . .	250
H. R. Packard <i>et al.</i> , . . .	Bungy, . . .	Attleborough, . . .	500
Walter C. Slocum, . . .	Tuxet, . . .	Dartmouth, . . .	250
George B. Treen, . . .	Lowland, . . .	Mansfield, . . .	250
Rev. Jas. J. Brady, . . .	Herring River, . . .	Rochester, . . .	250
Seth Damon, . . .	Mill, . . .	Weymouth, . . .	500

Fingerling Brook Trout Plants — Concluded.

APPLICANT.	Name of Brook.	Town.	Number.
George B. Clark, . . .	Trap-hole,	East Walpole, . . .	500
John J. Kennedy, . . .	Dead Meadow,	Stoughton,	500
J. A. Davis <i>et al.</i> , . . .	Flat,	Ware,	500
Edward Miller <i>et al.</i> , . . .	Parsons and Robert's Meadow, . . .	Northampton, . . .	1,000
F. M. Smith,	Buttery,	South Hadley, . . .	1,000
R. D. Bisbee,	Page,	Chesterfield, . . .	250
E. P. Bartlett <i>et al.</i> , . . .	Cook,	Pelham,	500
J. W. Jackson,	Padding Mill,	Belchertown, . . .	250
W. S. Gabb,	Shaw,	Cummington, . . .	500
J. A. Morrison,	Factory,	Middlefield, . . .	250
Jas. F. Page <i>et al.</i> , . . .	Plum,	South Amherst, . .	1,000
			45,875

PONDS STOCKED AND CLOSED IN ACCORDANCE WITH CHAPTER 91, SECTION 19, REVISED LAWS, AS AMENDED BY CHAPTER 274, ACTS OF 1903.

NAME OF POND.	Town.	Rainbow Trout Fingerlings.	Brown Trout Fingerlings.	Landlocked Salmon Fingerlings.	Pike Perch Fry.	Smelt Eggs.	Brook Trout Fingerlings.
Lashaway Lake, ¹ . . .	Brookfield,	500	-	-	-	-	-
Onota Lake,	Pittsfield,	500	-	1,000	-	-	-
Foster's,	Andover,	500	-	-	-	-	-
Dennison Lake,	Winchendon, . . .	500	-	-	-	-	-
Naukeag Lake,	Ashburnham, . . .	500	-	500	-	-	1,000
Crystal Lake,	Gardner,	500	-	1,000	-	2,000,000	-
Nabnasset,	Westford,	500	-	-	-	-	-
Whalom Lake,	Lunenburg,	500	-	-	-	-	-
Round,	Tewksbury,	500	-	-	-	-	-
Garfield Lake,	Monterey,	-	-	1,000	-	-	-
Walden,	Concord,	-	-	500	-	2,000,000	1,000
Peters,	Dracut,	-	500	-	-	2,000,000	-
Nagog,	Acton and Littleton, . . .	-	500	500	-	2,000,000	-
Robins,	East Bridgewater, . . .	-	500	-	-	-	-
Cooper's,	North Carver, . . .	-	500	-	-	-	-
Whitman's,	Weymouth,	-	500	-	-	-	-
Lead Mine,	Sturbridge,	500	-	-	100,000	-	-
Big Alum,	Sturbridge,	-	500	-	-	-	-
Winneconnett,	Norton,	-	500	-	-	-	-
		5,000	3,500	4,500	100,000	8,000,000	2,000

¹ Stocked upon evidence that in 1794 it was a great pond of the State. Later investigations satisfied the commissioners that it is an artificial pond, made by a dam erected in 1785, and therefore private property.

PONDS RESTOCKED IN 1905.

NAME OF POND.	Town.	Rainbow Trout Fingerlings.	Brown Trout Fin- gerlings.	Landlocked Salmon Fingerlings.	Pike Perch Fry.	Brown Trout Fry.	Smelt Eggs.	Adult Brook Trout.
Haggett's,	Andover,	-	500	-	-	-	-	-
Baddacook,	Groton,	-	500	-	-	5,000	-	-
Long,	Royalston,	500	-	-	100,000	-	-	-
Forge,	Littleton,	500	-	-	-	-	-	-
Spectacle,	Littleton,	-	-	1,000	-	-	-	-
Flax,	Lynn,	500	-	-	-	-	-	-
Queen,	Phillipston,	500	-	-	-	-	-	-
North,	Orange,	-	-	1,000	-	-	2,000,000	-
Massapoag,	Sharon,	-	-	-	100,000	-	4,000,000	-
Pleasant,	Wenham,	-	-	-	100,000	-	-	-
Long,	Tewksbury,	-	-	-	100,000	-	-	-
Long,	Freetown,	-	-	-	100,000	-	-	-
Great,	North Andover, . . .	-	-	-	100,000	-	-	-
Quannapowitt, . . .	Wakefield,	-	-	-	100,000	-	-	-
Packard,	Orange,	-	-	-	-	-	2,000,000	-
Greenwater,	Becket,	-	-	-	-	-	2,000,000	-
Assowompsett, . . .	Lakeville,	-	-	-	-	-	2,000,000	-
Forest,	Palmer,	-	-	-	-	-	-	28
Chaubunagungamaug,	Webster,	-	-	-	-	-	-	40
		2,000	1,000	2,000	700,000	5,000	12,000,000	68

BROOK STOCKED WITH BROOK TROUT AND CLOSED IN ACCORDANCE
WITH SECTION 5, CHAPTER 91 OF THE REVISED LAWS.

NAME OF BROOK.	Town.	Number.
South Meadow Brook,	Shrewsbury,	200

[C.]

DISTRIBUTION OF PHEASANTS.

Pheasants were liberated in the covers in various sections of the State, as indicated in the following list, which also embraces the names of applicants for birds:—

APPLICANT.	Town.	Number.
George H. Haines,	Sandwich,	6
Arthur J. Wallen,	Campello,	6
L. D. Baker,	Wellfleet,	6
Seth Damon,	Weymouth,	6
Charles S. Baker,	Falmouth,	6
A. I. Bailey,	Middleborough,	6
Frank H. Shute,	Gloucester,	6
Amos A. Phelps,	Rockland,	6
Murray D. Lincoln,	Raynham,	6
James Lehan,	Stoughton,	6
Charles H. Walker,	Amesbury,	6
Frank M. Chace,	Fall River,	6
James E. Donoghue,	Lawrence,	10
Fred P. Smith,	Dedham,	10
W. H. Reynolds,	Braintree,	10
John N. Cole,	Andover,	10
J. Sidney White,	North Acton,	10
Wellington K. Henry,	Pittsfield,	8
H. P. Wookey,	Stockbridge,	8
Frank Cass,	Franklin,	8
John C. Dudley,	Wilkinsonville,	8
Edward E. Whiting,	West Upton,	8
S. Frank Stockwell,	Auburn,	8
James Lehan,	Stoughton,	10
W. C. Woodward,	Middleborough,	10
Charles M. Kimball,	South Acton,	10
Warren H. Beede,	Lynn,	10
Edward B. Nevin,	South Weymouth,	10
Edward F. Woods,	West Newton,	10
Walter H. Edgerly,	Bridgewater,	10
Charles E. Conant,	Dedham,	10
Norman E. Lemaire,	Taunton,	10
Franklin S. Simmons,	Somerset,	10
Guy C. Wonson,	Gloucester,	10

APPLICANT.	Town.	Number.
John Kenrick,	Orleans,	10
Edward G. Clark,	Westfield,	10
George W. Field,	Sharon,	12
William H. Frost,	Athol,	10
Sanborn G. Tenney,	Williamstown,	10
Dana Malone,	Greenfield,	10
Edward Miller, Secretary,	Northampton,	10
George W. Lovell,	Middleborough,	10
A. P. Wright,	Chesterfield,	10
C. M. Pettengill,	Cummington,	10
A. C. Stevens,	Worthington,	10
Edward F. Staples,	East Taunton,	10
William T. Swain,	Nantucket,	10
F. H. Smith,	South Hadley,	10
C. F. Jacobus,	Turner's Falls,	10
C. H. Morse,	Petersham,	10
W. H. Walker,	Greenwich,	10
Francis C. Packard,	Quincy,	10
George W. Field,	Sharon,	6
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[D.]

DISTRIBUTION OF BELGIAN HARES.

APPLICANT.	Town.	Number.
Arthur J. Wallen,	Campello,	8
George H. Haines,	Sandwich,	8
A. I. Bailey,	Middleborough,	8
C. S. Baker,	Falmouth,	8
James Lehan,	Stoughton,	8
Clifton Fears,	Rockport,	8
Charles H. Carroll,	Gloucester,	8
Arthur S. Aborn,	Wakefield,	8
Charles M. Kimball,	South Acton,	8
Sanborn G. Tenney,	Williamstown,	16
Guy C. Wonson,	Gloucester,	10
John N. Cole,	Andover,	10
W. H. Reynolds,	Braintree,	10
John C. Dudley,	Sutton,	10
J. F. Despeaux,	West Upton,	10
C. E. Conant,	Dedham,	15
Fred Skinner,	Lynnfield Centre,	15
Ernest H. Ives,	Reading,	8
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[E.]

ARRESTS AND CONVICTIONS.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
George W. Sampson,	New Bedford,	{ Taking shellfish (R. L., c. 91, § 114). }	Convicted,	\$5 00	Failed to pay; jail.
Wm. B. Nooncs,	New Bedford,		Convicted,	5 00	
Vasco Page,	New Bedford,		Convicted,	5 00	
Manuel Oliver,	New Bedford,		Convicted,	5 00	
Manuel Pocheo,	New Bedford,		Convicted,	5 00	Arrested March 8, second of- fence, not pressed.
Manuel Antonio,	New Bedford,		Convicted,	5 00	
Joseph Santos,	New Bedford,		Convicted,	5 00	
John P. Boland,	Dartmouth,		Convicted,	5 00	
Peter J. Forehand,	Dartmouth,		Convicted,	5 00	
Joseph Gomes,	Dartmouth,		Convicted,	5 00	
Joseph Costa,	Dartmouth,		Convicted,	5 00	Appealed; withdrew and settled.
Joseph Frasier,	Dartmouth,		Convicted,	5 00	
Frank Medaros,	Dartmouth,		Convicted,	5 00	
Henry Souza,	Dartmouth,		Convicted,	5 00	
Antone Gracia,	Dartmouth,		Convicted,	5 00	
Joseph Mello,	Dartmouth,		Convicted,	5 00	
Manuel J. Silva,	Dartmouth,		Convicted,	5 00	
Alphonse Beaudry,	Dartmouth,		Convicted,	5 00	
John Cook,	Dartmouth,	{ Illegal possession of twenty-six rab- bits.	Convicted,	10 00	Appealed; withdrew and settled.
Octave Benjamin,	New Bedford,		Convicted,	Filed.	
George A. Burns,	Tiverton, R. I.,		Convicted,	10 00	
Frank Stevenson,	Tiverton, R. I.,		Convicted,	Filed.	
John Doe,	New Bedford,		Convicted,	Filed.	
Manuel Ferris,	New Bedford,		Convicted,	Filed.	
Joseph Sylvia,	New Bedford,		Convicted,	Filed.	
Arthur A. Reed,	Fall River,		Convicted,	—	
Wm. E. Reed,	Fall River,		Discharged,	—	
			Discharged,	—	

Charles McCarthy,	South Boston,	Short lobsters,	Convicted,	Filed.	
Oliver Desforge,	Fall River,	Song birds in possession,	Discharged,	—	
John Ouisnell,	Fall River,	Short bass,	Convicted,	10 00	
Chester M. Chase,	Providence, R. I.,	Hunting woodcock and partridge,	Convicted,	20 00	
Albert Reynolds,	Fairhaven,		Convicted,	Filed.	
Charles Reynolds,	Fairhaven,		Convicted,	Filed.	
William Warren,	Fairhaven,		Convicted,	Filed.	
John Watson,	New Bedford,	Taking clams (R. L., c. 91, § 114),	Convicted,	5 00	
Joseph Lepoint,	New Bedford,		Convicted,	5 00	
Luca Allen,	New Bedford,		Convicted,	5 00	
Joseph Magner,	New Bedford,		Convicted,	5 00	
B. N. Chase,	Freetown,		Convicted,	5 00	
Zebb Chadwell,	New Bedford,	Taking quahaugs (R. L., c. 91, § 114),	Convicted,	5 00	
Zachariah Chadwell,	New Bedford,		Convicted,	Filed.	
Fredrick Breilou,	New Bedford,		Convicted,	5 00	
Joseph Gansove,	New Bedford,		Convicted,	5 00	
Manuel Francis,	New Bedford,		Convicted,	5 00	
Manuel Lawrence,	New Bedford,		Convicted,	5 00	
Nepolian Bestil,	New Bedford,		Convicted,	5 00	
Alfonys Damos,	New Bedford,	Taking clams (R. L., c. 91, § 114),	Warrant out,	—	
Lawrence Lynch,	New Bedford,		Convicted,	5 00	Went to jail.
Harry H. Shepard,	New Bedford,	Taking quahaugs (R. L., c. 91, § 114),	Convicted,	5 00	
Peter Murphy,	Fairhaven,	Taking scallops,	Convicted,	Filed.	
Wm. H. Dyer,	Acushnet,	Taking clams (R. L., c. 91, § 114),	Convicted,	10 00	
George W. Dexter,	New Bedford,	Hunting on Lord's Day,	Discharged,	—	
Arthur Maher,	New Bedford,		Convicted,	5 00	Went to jail.
Henry Maher,	New Bedford,	Taking clams (R. L., c. 91, § 114),	Convicted,	2 00	
Edward Lewis,	New Bedford,	Short pickerel,	Convicted,	2 00	
William A. Hammond,	Acushnet,		Convicted,	5 00	Went to jail.
Joseph Durrlesie,	Fairhaven,	Taking clams (R. L., c. 91, § 114),	Convicted,	5 00	
Joseph Richards,	New Bedford,		Convicted,	5 00	
Levi Burgess,	New Bedford,	Taking quahaugs (R. L., c. 91, § 114),	Convicted,	10 00	
John B. Masdroline,	Fall River,		Convicted,	60 00	Went to jail.
Louis Sicily,	Fall River,	Hunting without license; killing song birds (ten robtus),	Convicted,	50 00	\$10 on first charge, \$50 on second.
William Pel,	Fall River,		Convicted,	10 00	Went to jail.
Fred Robinson,	New Bedford,		Convicted,	10 00	
William Robinson,	New Bedford,	Hunting on Lord's Day,	Convicted,	10 00	
Edward Morrison,	New Bedford,		Convicted,	10 00	
John G. Hammerschmidt,	New Bedford,		Convicted,	10 00	
George Hammerschmidt,	New Bedford,	Taking clams (R. L., c. 91, § 114),	Convicted,	10 00	
William H. Davis,	New Bedford,		Convicted,	Filed.	
Jerome Stowell,	Dartmouth,	Hunting on Lord's Day,	Convicted,	10 00	
Manuel Frates,	Dartmouth,		Convicted,	5 00	
George A. Daniels,	Fairhaven,	Taking clams (R. L., c. 91, § 114),	Convicted,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws—Continued.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Hector Brodie,	Groveland,	{ Killing a deer, }	Convicted,	\$100 00	Failed to pay; two months, house of correction.
David Forbush,	Lynn,	{ }	Convicted,	100 00	Appealed; discharged.
Russell Forbush,	Lynn,	{ }	Convicted,	100 00	Appealed; discharged.
Herbert Myers,	Lynn,	{ }	Convicted,	100 00	Appealed; discharged.
Austin W. Flint,	Danvers,	Six smelts, close season,	Convicted,	6 00	Appealed; paid.
William Driscoll,	Seftuate,	Eighteen short lobsters,	Convicted,	36 00	
Miles F. Gordon,	Crescent Beach,	Five lobster tails,	Discharged,	-	
Angelo Arrubino,	Saugus,	Hunting on Lord's Day; hunting without license,	Convicted,	20 00	Sunday charge filed.
Irwin C. Paine,	Marblehead,	{ Hunting on Lord's Day; using ferret, }	Convicted,	20 00	Sunday charge filed.
D. H. Finnegan,	Marblehead,	{ }	Convicted,	20 00	
William J. Ryan,	Revere,	Hunting on Lord's Day,	Discharged,	-	
John Lindberg,	Winthrop,	Twenty short lobsters,	Convicted,	20 00	
Hartley Wells,	Winthrop,	Three short lobsters,	Convicted,	15 00	
Joaquin P. Silva,	Pedlocks Island,	Fourteen short lobsters,	Convicted,	52 00	
Elvin W. Taylor,	Hough's Neck,	{ Robbing traps; short lobsters, }	Convicted,	26 00	Robbing traps filed.
Dolor Martell,	Hough's Neck,	{ }	Defaulted,	-	
Antone Vieira,	Boston,	Thirty-eight short lobsters,	Convicted,	38 00	
Frank Brengoli,	Boston,	Four shorts, one seed lobster,	Convicted,	15 00	
Joseph Longone,	Chelsea,	Hunting without license,	Convicted,	10 00	Appealed; paid.
Lorenzo B. Creamer,	Everett,	{ }	Convicted,	10 00	Appealed; paid.
William Musgrave,	Everett,	{ Hunting on Lord's Day, }	Convicted,	10 00	
John Fisher,	Cohasset,	{ }	Convicted,	15 00	
L. W. Morrison,	Braintree,	Hunting on Lord's Day; having one bird,	Convicted,	15 00	
Thomas Mitchell,	South Boston,	Twenty-two short lobsters,	Convicted,	33 00	
John Carlson,	South Boston,	{ Hunting on Lord's Day; having three birds, }	Convicted,	15 00	
Lewis Mitchell,	Pleasant Bay, Me.,	{ Having in possession and selling gull feathers, }	Convicted,	15 00	
J. P. Squire, Sylvester L. Ricker, Manager,	Worcester,	Having seven partridge, close season,	Convicted,	Filed.	Forfeiture of feathers.
Eastern States Ref. Co.,	Springfield,	Having thirty-seven partridge and five woodcock, close season,	Convicted,	Filed.	Paid costs of \$40.
Frederick H. Smith,	Somers, Conn.,	Owning two dogs that chased deer,	Convicted,	60 00	
Frank H. Hunt,	Baldwinsville,	Owning dog that chased deer,	Convicted,	20 00	
Leonidas Quentin,	Athol,	{ Hunting on Lord's Day; possession of ferret, }	Convicted,	20 00	Sunday hunting charge filed.
Joseph Bordaoux,	Athol,	{ }	Convicted,	Filed.	Payment of costs, \$3.38.

Gates Wright, . . .	Russell, . . .	{ Owning dog that chased deer, . . .	Convicted, . . .	20 00	Ordered to remove sawdust.
Harry With, . . .	North Dana, . . .	{ Having four partridge, close season, . . .	Convicted, . . .	20 00	Appealed.
Nelson A. Bliss, . . .	Millington, . . .	{ Sawdust pollution, . . .	Discharged, . . .	—	Filed three counts; fine on one.
Fred J. Baker, . . .	Holyoke, . . .	{ Four short trout, . . .	Convicted, . . .	8 00	
Lucas S. Lawless, . . .	New Salem, . . .	{ Fishing Sutton Pond (R. L., c. 91, § 29, . . .	Convicted, . . .	5 00	Paid costs of \$7.
John A. Carter, . . .	Petersham, . . .		Convicted, . . .	10 00	Costs, \$6; continued three months for sentence. No further action if pollution ceases.
Bowen, Hadley & Co., . . .	Templeton, . . .		Convicted, . . .	—	Costs, \$2.63; promised to remove sawdust.
Wm. Mongeau, . . .	Chilcopee Falls, . . .		Convicted, . . .	15 00	Appealed; fined \$15.
Monroe Cook, . . .	Worcester, . . .		Convicted, . . .	20 00	Paid costs, \$3.75.
Albert J. Baker, . . .	Shutesbury, . . .		Convicted, . . .	20 00	Paid costs, \$3.75.
Frank Williams, . . .	North Orange, . . .		Convicted, . . .	20 00	Paid costs, \$3.65.
Elisha P. Whitney, . . .	Winchendon, . . .	{ Sawdust pollution, . . .	Convicted, . . .	20 00	Appealed; not prosed.
Oliver L. Mann, . . .	Winchendon, . . .		Convicted, . . .	20 00	Appealed; not prosed.
Nelson W. Wymen, . . .	Winchendon, . . .		Convicted, . . .	20 00	Fined for one; two filed.
Wildor P. Clark, . . .	Winchendon, . . .		Convicted, . . .	20 00	Fined for one; two filed.
Silas S. Richardson, . . .	Montague, . . .	{ Fishing closed pond, . . .	Convicted, . . .	10 00	
Joseph Brewster, . . .	Holyoke, . . .	{ Fishing Sutton Pond, . . .	Convicted, . . .	100 00	
George Rupelle, . . .	Worcester, . . .		Convicted, . . .	40 00	
Oscar Willson, . . .	Worcester, . . .		Discharged, . . .	—	
John Brigham, . . .	Worcester, . . .		Convicted, . . .	30 00	
Charles Julian, . . .	Worcester, . . .		Convicted, . . .	9 00	
Roswell Allen, . . .	Belchertown, . . .	{ Killing partridge, close season, . . .	Convicted, . . .	50 00	
Edward Barrows, . . .	Westfield, . . .	{ Buying and offering for sale three partridge, . . .	Convicted, . . .	100 00	
J. T. Smith, . . .	Worcester, . . .	{ Buying and offering for sale eighteen birds, . . .	Convicted, . . .	40 00	
D. H. Stevers & Co., . . .	Springfield, . . .		Discharged, . . .	—	
George C. Finch, . . .	Thompsonville, . . .		Convicted, . . .	12 00	
George Jackson, . . .	Springfield, . . .		Discharged, . . .	9 00	
George A. Manter, . . .	Plymouth, . . .		Convicted, . . .	50 00	
Ansel P. Hoves, . . .	Dennis, . . .		Convicted, . . .	100 00	
Benjamin Walker, . . .	Roxbury, . . .		Convicted, . . .	—	
John T. Dixon, . . .	Woods Hole, . . .		Convicted, . . .	—	
P. M. Stuart, . . .	Gay Head, . . .		Convicted, . . .	—	
Joseph Lang, . . .	Brewster, . . .		Discharged, . . .	—	
Freeman Ellis, . . .	Brewster, . . .		Convicted, . . .	10 00	
Gideon E. Hall, . . .	South Wellfleet, . . .	{ Setting fyke without license, . . .	Convicted, . . .	10 00	
Jeremiah F. Rich, . . .	Wellfleet, . . .		Convicted, . . .	10 00	
Edwin P. Cook, . . .	Wellfleet, . . .		Convicted, . . .	—	

Served two months in jail; paid October 5.
Had permit for fish trap.

John Olson,	Manchester,	Hunting on Lord's Day; shooting sea fowl,	Convicted,	20 00	Bird-shooting charge filed.
Harry Brown,	Manchester,	Fishing closed pond,	Convicted,	20 00	Bird-shooting charge filed.
Pierre Senecal,	Taunton,	Two short bass,	Convicted,	5 00	
Benjamin Tremblay,	Lynn,	Twenty-four short lobsters,	Convicted,	5 00	
George H. Williams,	Manchester,	One hundred and twenty-eight short lobsters,	Convicted,	24 00	
Joseph S. West,	Gloucester,		Convicted,	25 00	
Peter Knutson,	Everett,		Convicted,	10 00	
Edgar A. Cook,	Melrose,		Convicted,	10 00	
Alfred Swain,	Boston,	Hunting on Lord's Day,	Convicted,	10 00	
Chas. F. Thomas,	Boston,		Convicted,	10 00	
Claude N. Hawkins,	Boston,		Convicted,	10 00	
Charles R. Mackay,	Reading,		Convicted,	10 00	
Samuel W. Mackay,	Reading,		Convicted,	10 00	
Jude Ledger,	New Bedford,		Convicted,	10 00	
Simon P. Casey,	New Bedford,	Taking clams (R. L., c. 91, § 114),	Convicted,	10 00	
Peter Babineau,	New Bedford,		Convicted,	10 00	
Alfred Denault,	New Bedford,	Offering partridge for sale in close season,	Convicted,	10 00	
George H. Jilson,	Lynn,		Convicted,	Filed.	
Peter Gepson,	Lynn,	Hunting on Lord's Day,	Convicted,	10 00	
George Smith,	Lynn,		Convicted,	10 00	
George Guib,	Attol,	Having short trout,	Convicted,	Filed.	On recommendation.
B. C. Richardson,	Sturbridge,		Convicted,	Filed.	Paid costs, \$6.
Edwin Wallace,	Paxton,	Sawdust pollution,	Convicted,	Filed.	Paid costs, \$10.
E. E. Eames,	Moore's Corner,		Convicted,	10 00	Appealed; paid in Superior Court.
William McDonald,	Paxton,	Sawdust pollution; second offence,	Convicted,	25 00	Appealed, fined \$25; paid.
Jacob Reiff,	Boston,	Hunting on Lord's Day,	Convicted,	Filed.	Sentence suspended until September 9.
	Belchertown,	Owning dog that chased deer,	Convicted,	20 00	
J. W. Williams,	Springfield,	Short trout,	Convicted,	10 00	
Elmer M. Thayer,	Hardwick,	Killing a deer,	Convicted,	30 00	
Clayton Adams,	Oakham,	Illegal fishing,	Discharged,	-	
Robert E. Ezolds,	Holyoke,		Convicted,	20 00	
Luigi Andres,	Braintree,	Hunting without license,	Discharged,	-	
Canillo Firman,	Braintree,		Discharged,	-	
Vincenzo Cardalli,	Quincy,		Convicted,	10 00	
Walter Jackman,	Salisbury,		Convicted,	10 00	
Charles Jones,	Salisbury,		Convicted,	10 00	
H. P. Berry,	Watertown,	Hunting on Lord's Day,	Convicted,	20 00	
George F. Holmes,	Plymouth,		Convicted,	20 00	Appealed.
James S. Clark,	Plymouth,		Convicted,	10 00	Appealed.
Augustus Fuller,	Brookline,		Discharged,	10 00	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE P. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
William Green,	Dover,	Hunting with ferret; killing rabbit with ferret,	Convicted,	\$40 00	
Henry C. Blake,	Holliston,	Hunting on Lord's Day; killing quail out of season,	Convicted,	30 00	
Charles A. Clark,	Sherborn,	Killing partridge out of season,	Convicted,	20 00	
Clarence H. Leonard,	Marshfield Hills,	Setting trap; possession of duck,	Convicted,	40 00	\$20 on each charge; appealed.
Henry Mills,	Medway,	Having six short trout,	Convicted,	60 00	
C. L. Stevens,	Scituate,	Having four short lobsters,	Convicted,	10 00	Appealed.
John Stonefield,	Scituate,	Having five short lobsters,	Convicted,	25 00	Appealed.
Arthur E. Gunterson,	Scituate,	Having fourteen short lobsters,	Convicted,	70 00	Appealed.
Joe Batron,	Attol,	Ferretting; Sunday hunting,	Convicted,	Filed.	Paid costs.
George E. Stevens,	Westwood,	Short trout,	Convicted,	10 00	
Elizabeth Joseph,	Lawrence,		Convicted,	10 00	
Callian Devire,	Lawrence,		Convicted,	10 00	
Serne Ernest,	Lawrence,		Convicted,	10 00	
Vanceukist Arthur,	Lawrence,		Convicted,	10 00	
Charles Laforey,	Lawrence,		Convicted,	10 00	
Vanbellingham Florimond,	Lawrence,		Convicted,	10 00	
Wilbur A. Parsons,	Easthampton,		Convicted,	5 00	
Raymond S. Parsons,	Easthampton,		Convicted,	5 00	
Myron J. Parsons,	Easthampton,		Convicted,	5 00	
Edward C. Burpee,	Northampton,	Spearing in Connecticut River,	Convicted,	5 00	
James F. Martin,	Northampton,		Convicted,	5 00	
Richard T. Ennis,	Northampton,		Convicted,	5 00	
Francisco Penier,	Concord,		Convicted,	20 00	
Frederic Nazarro,	Concord,	Shooting song-birds,	Convicted,	40 00	Appealed; paid \$30 in Superior Court.
Earle N. Farrar,	Conway,		Convicted,	10 00	
Robert H. Hart,	Conway,	Hunting on Lord's Day,	Convicted,	10 00	
A. W. Frost,	So. Framingham,	Having three young woodcock,	Convicted,	30 00	
Henry Hughes,	Natick,		Convicted,	10 00	
James Holbrook,	West Bridgewater,		Convicted,	10 00	
Edward Pittsley,	West Bridgewater,	Hunting on Lord's Day,	Convicted,	10 00	
Charles Fenton,	West Bridgewater,		Convicted,	10 00	
William H. King,	Brockton,	Selling trout,	Convicted,	Filed.	
Stanley Bickwicke,	Andover,	Hunting without license,	Convicted,	10 00	
John Forage,	Andover,		Convicted,	10 00	
Keller Gorge,	Adams,	Shooting song-birds,	Convicted,	-	Paid costs, \$3.98.
Andrew Massun,	Adams,	Hunting without license,	Convicted,	-	Paid costs, \$4.98; pleaded ignorance.

C. A. Collins, .	Millford, .	Hunting on Lord's Day; one rabbit,	Convicted,	30 00
George Frelas, .	Somers, Conn., .	Owner of dog that killed deer,	Convicted,	20 00
James J. Leary, .	Boston, .	Having game on Sunday, .	Discharged,	Filed.
William Walsh, .	Boston, .	Shooting from power boat,	Discharged,	-
John Damon, Jr., .	Cohasset, .		Convicted,	-
Ellery Clark, .	Cohasset, .		Convicted,	Filed.
Ernest Griffin, .	Annisquam, .		Convicted,	Filed.
A. H. Griffin, .	Annisquam, .	Illegal fishing,	Convicted,	Filed.
James Wheeler, .	Annisquam, .		Convicted,	Filed.
Clarence Davis, .	Annisquam, .		Convicted,	Filed.
George Currier, .	Annisquam, .		Convicted,	Filed.
Frank Butler, .	Annisquam, .		Convicted,	Filed.
George Young, .	Boston, .	Hunting on Lord's Day; shooting	Convicted,	20 00
Luigi Ceirillo, .	Boston, .	song-birds,		\$10 on each charge.
Pazzi Cercianno, .	Boston, .	Hunting on Lord's Day; shooting	Convicted,	
Salvatore Todario, .	Boston, .	song-birds; hunting without	Convicted,	\$10 on each charge.
Sassiro Ciccole, .	Boston, .	license,	Convicted,	\$10 on each charge.
Frank LaCamara, .	Boston, .	Shooting song-birds; hunting with-	Convicted,	\$10 on each charge.
Olie N. Cole, .	Westhampton, .	out license,	Convicted,	10 00
Albert E. Delson, .	Westhampton, .	Hunting without license,	Convicted,	10 00
Harold Thurston, .	Everett, .		Discharged,	Minor.
A. S. Marden, .	Everett, .	Hunting on Lord's Day,	Convicted,	10 00
Theophile Pillote, .	Fall River, .	Song bird in possession,	Convicted,	10 00
Ferdinand J. Snell, .	Tiverton, R. I., .	Green heron in possession, . . .	Convicted,	10 00
Giovanni Parazzi, .	Fall River, .	Shooting song-bird; hunting with-	Convicted,	Filed.
James Denizio, .	Providence, R. I., .	out license,	Convicted,	20 00
John Venditti, .	Providence, R. I., .	Hunting on Lord's Day; hunting	Convicted,	20 00
Manuel Silva, .	Swansea, .	without license,	Convicted,	20 00
Manuel Grassie, .	Cohasset, .	Hunting without license,	Convicted,	10 00
Thomas Grassie, .	Cohasset, .	Hunting on Lord's Day; having	Discharged,	
George Mitchell, .	Cohasset, .	birds in possession,	Discharged,	-
Angelo Manhiadell, .	Gardner, .	Hunting on Lord's Day; hunting	Discharged,	-
Ernest Granelli, .	Boston, .	without license,	Convicted,	Sunday charge filed.
Nicholas Sagonomo, .	Boston, .	Shooting song-birds,	Convicted,	25 00
Edward Boyd, .	Randolph, .		Convicted,	15 00
John F. Mahoney, .	Randolph, .	Hunting on Lord's Day,	Convicted,	15 00
Tony Palombo, .	East Cambridge, .		Convicted,	10 00
Antonio Antonelli, .	Boston, .	Shooting song-birds,	Convicted,	10 00
Christos Fafaras, .	South Chelmsford, .	Hunting on Lord's Day,	Discharged,	-
Napoleon J. Tremblay, .	Pittsfield, .	Fishing closed pond,	Convicted,	10 00
			Convicted,	2 00

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Concluded.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Phillip Mongen,	Ashley Falls,	Constructing and setting snares; hunting without license;	Convicted,	\$30 00	\$20 on first charge; \$10 on second.
Mainette Oresti,	Lee,	Hunting without license; hunting on Lord's Day; having birds in possession,	Convicted,	35 00	\$15, \$10 and \$10.
Tunetra Martins,	Lee,	Hunting on Lord's Day,	Convicted,	35 00	\$15, \$10 and \$10.
Charles Kitner,	Westfield,	Hunting on Lord's Day,	Convicted,	Filed.	
A. H. Sherman,	Westfield,		Convicted,	10 00	
Amiel Camyer,	Westfield,		Convicted,	10 00	
C. J. Loomis,	Westfield,		Convicted,	10 00	
William Rice,	Westfield,		Convicted,	10 00	
H. W. Charter,	Tariffville, Conn.,		Convicted,	30 00	
E. A. Pond,	Tariffville, Conn.,	Seining in great pond,	Convicted,	30 00	
Albert G. Taylor,	Tariffville, Conn.,		Convicted,	Filed.	A minor.
Arthur E. Mason,	Tariffville, Conn.,		Convicted,	30 00	
Mike Smith,	Northampton,	Setting nets in old bed, tributary to Connecticut River,	Convicted,	25 00	Committed.
Tony Wallace,	Northampton,		Convicted,	25 00	
Frank Onunskie,	Springfield,	Hunting without license; shooting song-birds,	Convicted,	25 00	
Otonio Bernarodi,	Springfield,		Convicted,	30 00	
Frank Vollinger,	Hatfield,	Hunting on Lord's Day,	Convicted,	30 00	
Peter Dopman,	Hatfield,	Hunting on Lord's Day; having partridge,	Convicted,	10 00	
Joseph L. Pierce,	Plymouth,		Convicted,	30 00	
Charles Sanderson,	Plymouth,		Convicted,	15 00	
Robert McIntosh,	Jamaica Plain,		Discharged,	—	
John Simmons,	Duxbury,	Hunting on Lord's Day,	Convicted,	15 00	
William Thomas,	Cambridge,		Convicted,	15 00	
Henry Jose,	Brookfield,		Convicted,	10 00	
Zoeth Sherman,	Yarmouth,	Setting fish trap,	Convicted,	10 00	

[F.]

LEGISLATION.

Acts of 1905.

[CHAPTER 73.]

AN ACT TO EXTEND THE CLOSE SEASON ON PHEASANTS.

Be it enacted, etc., as follows:

SECTION 1. Section sixteen of chapter ninety-two of the Revised Laws is hereby amended by striking out in the first and second lines the words "thirteenth day of February in the year nineteen hundred and five", and inserting in place thereof the words:—open season for partridge and quail in the year nineteen hundred and seven,—so as to read as follows:—*Section 16.* Whoever, prior to the open season for partridge and quail in the year nineteen hundred and seven, takes, kills or has in possession, except for the purpose of propagation, a Mongolian, English or golden pheasant shall be punished by a fine of twenty dollars for each bird.

SECTION 2. This act shall take effect upon its passage. [*Approved February 14, 1905.*]

[CHAPTER 81.]

AN ACT RELATIVE TO TAKING SHINERS FOR BAIT IN CERTAIN WATERS.

Be it enacted, etc., as follows:

SECTION 1. Section eighty-one of chapter ninety-one of the Revised Laws, as amended by section one of chapter one hundred and sixteen of the acts of the year nineteen hundred and four, is hereby further amended by inserting after the word "during", in the first line, the words:—October and,—by striking out the words "and December", in the first and second lines; and by inserting after the word "rivers", in the fourth line, the words:—and their tributaries,—so as to read as follows:—*Section 81.* During October and November any person may, for the purpose of taking shiners for bait, draw a net or seine at any point in the Merrimac and Connecticut rivers and their tributaries, except within four hundred yards of any fishway; and if any other fish so caught are immediately returned alive to the waters from which they were taken, the penalties prescribed in sections forty-six, forty-seven, forty-nine, seventy-eight and seventy-nine shall not apply to the taking of such fish.

SECTION 2. This act shall take effect upon its passage. [*Approved February 17, 1905.*]

[CHAPTER 122.]

AN ACT TO PROVIDE FURTHER FOR THE PROTECTION OF QUAIL ON THE
ISLAND OF NANTUCKET.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful to take, kill or have in possession any quail on the island of Nantucket at any time within three years after the first day of March in the year nineteen hundred and five.

SECTION 2. Whoever violates any provision of this act shall be punished by a fine of twenty dollars for every quail taken, killed or had in possession contrary to the provisions hereof. [*Approved, March 2, 1905.*]

[CHAPTER 190.]

AN ACT RELATIVE TO THE TAKING AND SALE OF SMALL TROUT.

Be it enacted, etc., as follows:

Section sixty-four of chapter ninety-one of the Revised Laws, as amended by section eleven of chapter five hundred and forty-four of the acts of the year nineteen hundred and two, is hereby further amended by striking out the words "the county of Berkshire nor to", in the eighth line, so as to read as follows:— *Section 64.* Whoever at any time takes, catches or has in possession, or whoever sells or offers or exposes for sale in this Commonwealth, trout less than six inches in length shall forfeit ten dollars for each such trout taken, caught, held in possession, sold or offered or exposed for sale; but the provisions of this section shall not affect the provisions of section twenty-eight, nor shall they apply to a person who is engaged in breeding or rearing trout or to any person who, upon taking such trout, immediately returns it alive to the water from which it was taken. [*Approved March 17, 1905.*]

[CHAPTER 245.]

AN ACT RELATIVE TO THE PROTECTION OF DEER FROM DOGS.

Be it enacted, etc., as follows:

Chapter ninety-two of the Revised Laws, as amended by section one of chapter one hundred and fifty-four of the acts of the year nineteen hundred and two, is hereby further amended by striking out section eighteen and inserting in place thereof the following:— *Section 18.* The owner or keeper of a dog found chasing or hunting deer at any time may be punished by a fine of not more than twenty dollars. Any of the commissioners on fisheries and game, or their deputies, or any member of the district police, or any officer qualified to serve criminal process, may kill a dog found chasing or hunting deer at any time if the dog is used for such purpose with the knowledge and consent of such owner or keeper, and the owner or keeper of such dog shall be punished by a fine of fifty dollars. If a dog has twice been found chasing or hunting

deer, and if the owner or keeper of the dog has so been notified on each occasion by the commissioners on fisheries and game, it shall be a presumption of law, if the same dog is thereafter found chasing or hunting deer, that such chasing or hunting was with the knowledge and consent of the said owner or keeper, unless the contrary is shown by evidence.
[Approved March 30, 1905.]

[CHAPTER 273.]

AN ACT TO REGULATE THE SHOOTING OF WILD DUCKS AND GEESE IN CERTAIN WATERS OF THE COUNTY OF DUKES COUNTY.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful in the county of Dukes County for any person to shoot or kill wild ducks or geese in any fresh water pond from a boat, raft or other device located at a greater distance than fifty yards from the shore.

SECTION 2. Any person violating any provision of this act shall be punished by a fine of not less than five nor more than two hundred and fifty dollars. [Approved April 7, 1905.]

[CHAPTER 281.]

AN ACT RELATIVE TO THE TAKING OF MENHADEN FOR BAIT IN THE WATERS OF EDGARTOWN AND COTTAGE CITY.

Be it enacted, etc., as follows:

SECTION 1. Section one hundred and twenty-seven of chapter ninety-one of the Revised Laws is hereby amended by adding at the end thereof the words: — nor shall they prevent the inhabitants of said towns from taking menhaden for bait for their own use in the waters of their respective towns in the months of July, August, September and October, — so as to read as follows: — *Section 127.* Whoever sets or uses or aids in setting or using any seine, mesh net or gill net for the purpose of catching any other fish than mackerel, or by such means catches and retains any other fish than mackerel, in the waters of the towns of Edgartown and Cottage City within three miles from the shores thereof, may, upon view of the offence by any of the commissioners on fisheries and game or their deputies, or any officer qualified to serve criminal process or member of the district police, be arrested without warrant and prosecuted by him; and on conviction thereof shall be punished by a fine of not more than two hundred dollars, and, in the discretion of the court, shall forfeit to the Commonwealth all fish taken in said nets. The provisions of this section shall not affect the rights of any persons mentioned in section twenty-three or the corporate rights of any fishing company; nor shall they prevent the inhabitants of said towns from taking menhaden for bait for their own use in the waters of their respective towns in the months of July, August, September and October.

SECTION 2. This act shall not restrict or affect the authority granted by chapter three hundred and one of the acts of the year nineteen hundred and four to the selectmen of the town of Edgartown to issue certain permits for the taking of bait.

SECTION 3. This act shall take effect upon its passage. [*Approved April 13, 1905.*]

[CHAPTER 317.]

AN ACT TO PROVIDE FOR GRANTING TO UNNATURALIZED, FOREIGN BORN PERSONS LICENSES TO HUNT.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful for any unnaturalized, foreign born person to hunt anywhere within the limits of the Commonwealth, unless he is licensed so to do as hereinafter provided.

SECTION 2. City and town clerks shall, upon the application of any unnaturalized, foreign born person who is a resident of the city or town in which the application is made, and upon the payment of a fee of fifteen dollars, issue to such person a license, upon a form to be supplied by the commissioners on fisheries and game, bearing the name, age and place of residence of the licensee, with a description of him, as near as may be, and authorizing the said licensee to hunt and to kill game on any lands in which such hunting or killing is not forbidden by law or by written or printed notices posted thereon by the owner, lessee or occupant thereof. Such license shall be good only for that period of the year when game may lawfully be killed, and shall authorize the hunting or killing of game only under such restrictions and for such purposes as are imposed or authorized by law. The said license shall not be transferable, and shall be exhibited upon demand to any of the commissioners on fisheries and game or their deputies, and to any game warden or deputy game warden, and to any sheriff, constable, police officer or other officer qualified to serve process. The fees received for the said licenses shall annually be paid into the treasury of the Commonwealth.

SECTION 3. A license granted hereunder shall be revoked by the city or town clerk issuing the same in case the licensee is convicted of a violation of the fish and game laws, or of hunting upon Sunday in violation of law.

SECTION 4. It shall be the duty of the commissioners on fisheries and game, upon request by any city or town clerk, to supply such clerk with license forms prepared in accordance with the provisions of this act.

SECTION 5. Whoever violates any provision of this act shall be punished by a fine of not less than ten nor more than fifty dollars. [*Approved April 21, 1905.*]

[CHAPTER 406.]

AN ACT RELATIVE TO THE CLOSE SEASON FOR QUAIL.

Be it enacted, etc., as follows:

Section three of chapter ninety-two of the Revised Laws, as amended by chapter one hundred and sixty-five of the acts of the year nineteen hundred and two, is hereby further amended by striking out the word "October", in the third line, and inserting in place thereof the word: — November, — and by adding at the end of the section the words: — *provided, however*, that any person, firm or corporation holding a permit from the commissioners on fisheries and game may sell or have in possession live quail for purposes of propagation within the Commonwealth, — so as to read as follows: — *Section 3.* Whoever takes, kills or has in possession, or buys, sells or offers for sale a quail, between the first day of December and the first day of November following, or, in the county of Bristol, between the fifteenth day of December and the first day of November following, whenever or wherever such bird may have been taken or killed, shall be punished by a fine of twenty dollars for each bird; but a person, firm or corporation dealing in game or engaged in the cold storage business may buy, sell or have in possession, and a person may buy from such person, firm or corporation, and have in possession if so bought, quail from the first day of December to the first day of May, except that, in the county of Bristol, this period shall be from the fifteenth day of December to the first day of May, if such quail were not taken or killed in this Commonwealth contrary to the provisions of this chapter; and a person, firm or corporation dealing in game or engaged in the cold storage business may have quail in possession on cold storage at any season, if such quail were not taken or killed in this Commonwealth contrary to the provisions of this chapter: *provided, however*, that any person, firm or corporation holding a permit from the commissioners on fisheries and game may sell or have in possession live quail for purposes of propagation within the Commonwealth. [Approved May 17, 1905.]

[CHAPTER 407.]

AN ACT RELATIVE TO THE AUTHORITY OF THE COMMISSIONERS ON FISHERIES AND GAME.

Be it enacted, etc., as follows:

Section three of chapter ninety-one of the Revised Laws is hereby amended by inserting before the word "Each", in the first line, the words: — The commissioners are empowered to appoint deputies, and, — so as to read as follows: — *Section 3.* The commissioners are empowered to appoint deputies, and each of the commissioners, the deputies of the commissioners or members of the district police may enforce the laws regulating fisheries; and may seize and remove, summarily if need be, all illegal obstructions to the passage of migratory fish except dams, mills or machinery, at the expense of the persons using or maintaining the same. [Approved May 17, 1905.]

[CHAPTER 414.]

AN ACT RELATIVE TO SHORE, MARSH AND BEACH BIRDS.

Be it enacted, etc., as follows:

Section five of chapter ninety-two of the Revised Laws, as amended by chapter one hundred and sixty-two of the acts of the year nineteen hundred and three, is hereby further amended by striking out the word "or", in the fourth line, and inserting in place thereof the words:— a Bartramian sandpiper, also called upland plover, before the fifteenth day of July in the year nineteen hundred and ten,— and by inserting after the word "pigeon", in the fifth line, the words:— a Carolina or mourning dove,— so as to read as follows:— *Section 5.* Whoever takes or kills a plover, snipe, sandpiper, rail or any of the so-called shore, marsh or beach birds between the first day of March and the fifteenth day of July, a Bartramian sandpiper, also called upland plover, before the fifteenth day of July in the year nineteen hundred and ten, a wild or passenger pigeon, a Carolina or mourning dove, a gull or tern at any time, shall be punished by a fine of ten dollars for every bird so taken or killed; but the provisions of this section shall not apply to the great American herring gull nor to the great black-backed gull between the first day of November and the first day of May following. [*Approved May 17, 1905.*]

[CHAPTER 417.]

AN ACT RELATIVE TO THE TAKING AND CATCHING OF PICKEREL.

Be it enacted, etc., as follows:

SECTION 1. A town may by a by-law duly enacted and approved as required by law forbid the taking or catching of pickerel in any river, stream or pond therein in any other manner than by naturally or artificially baited hook and hand line, and may provide a suitable penalty for the violation of such by-law.

SECTION 2. Section sixty-eight of chapter ninety-one of the Revised Laws, and chapter three hundred and sixty-four of the acts of the year nineteen hundred and four, are hereby repealed.

SECTION 3. This act shall take effect upon its passage. [*Approved May 18, 1905.*]

[CHAPTER 419.]

AN ACT TO PROVIDE FOR THE PROTECTION OF DEER.

Be it enacted, etc., as follows:

Section seventeen of chapter ninety-two of the Revised Laws, as amended by chapter two hundred and forty-five of the acts of the year nineteen hundred and three, is hereby further amended by striking out the section and inserting in place thereof the following:— *Section 17.* Whoever, before the first day of November in the year nineteen hundred and eight, hunts, chases, wounds, injures or kills a deer, or sells

or offers for sale or has in his possession for the purpose of sale, a deer captured or killed in Massachusetts, except his own tame deer kept on his own grounds, shall forfeit one hundred dollars for each offence: *provided, however*, that nothing contained herein shall prevent the owner or occupant of cultivated land from driving a deer therefrom; but dogs shall not be used for this purpose, nor shall the deer be wounded or injured. The possession of a deer killed in Massachusetts shall be *prima facie* evidence that the person having possession has violated some of the provisions of this section. [*Approved May 18, 1905.*]

[CHAPTER 429.]

AN ACT RELATIVE TO FISHING FOR PICKEREL IN LAKE QUINSIGAMOND AND ITS TRIBUTARIES.

Be it enacted, etc., as follows:

SECTION 1. Section one of chapter one hundred and fifty-eight of the acts of the year nineteen hundred and one is hereby amended by inserting after the word "fish", in the second line, the words:—except for pickerel,—and by inserting after the word "fish", in the eleventh line, the words:—except pickerel,—so as to read as follows:—*Section 1.* For a period of five years after the passage of this act no person shall fish, except for pickerel, in any manner whatsoever between the first day of September and the first day of April in each year in Lake Quinsigamond in the county of Worcester, or in its tributaries, above what is known as the Stringer dam, including Full Moon cove, Jordan pond and Newton pond commonly called Mud pond; and between the first day of April and the first day of September in each year during said period no person shall take from said lake or its tributaries as aforesaid any fish, except pickerel, in any manner except with a single hook and either a hand line or a line attached to a rod or pole held by hand, with bait, artificial fly or spoon.

SECTION 2. Section two of said chapter is hereby amended by inserting after the word "fish", in the first line, the words:—except pickerel,—so as to read as follows:—*Section 2.* No person shall take any fish, except pickerel, from said lake or its tributaries as aforesaid during said period of five years for the purpose of sale, trade or barter. [*Approved May 22, 1905.*]

Resolves of 1905.

[CHAPTER 12.]

RESOLVE TO AUTHORIZE THE COLLECTION OF STATISTICS IN REGARD TO DAMAGE CAUSED TO FOOD FISH BY PREDATORY FISH.

Whereas, there is pending in congress a bill to provide for the extermination of the dog-fish and other predatory fish; and

Whereas, to secure favorable action upon said bill, it is necessary that evidence of the damage caused by these fish be prepared and presented in proper form;

Now, therefore, be it *Resolved*, That there be allowed and paid out of the treasury of the Commonwealth a sum not exceeding two thousand dollars, to be expended under the direction of the commissioners on fisheries and game, for the purpose of collecting, preparing and printing evidence and statistics in regard to the damage caused to the fishing industry of this state by dog-fish, so-called, and by other fish which prey upon food fish. [*Approved February 27, 1905.*]

[CHAPTER 49.]

RESOLVE TO PROVIDE FOR AN INVESTIGATION AND REPORT BY THE COMMISSIONERS ON FISHERIES AND GAME AS TO SCALLOPS.

Resolved, That the commissioners on fisheries and game are hereby authorized and directed to investigate and report as to the time or times during each year when scallops propagate and as to the natural limit of their life, together with any other facts regarding scallops which the commissioners may think desirable to include in their investigation and report. Said commissioners may expend for the purposes of this resolve a sum not exceeding five hundred dollars. [*Approved April 13, 1905.*]

[CHAPTER 54.]

RESOLVE TO AUTHORIZE AND DIRECT THE COMMISSIONERS ON FISHERIES AND GAME TO TAKE CONTROL OF THE POWDER HOLE, SO-CALLED, AT MONOMOY POINT, IN THE TOWN OF CHATHAM, FOR THE PROPAGATION OF LOBSTERS.

Resolved, That the commissioners on fisheries and game are hereby authorized to take full control of the Powder Hole, so-called, at Monomoy Point, in the town of Chatham, for the purpose of propagating lobsters, to clean out and screen said Powder Hole, and to prohibit fishing or the taking of fish therein, and to impound egg-bearing lobsters therein and to rear lobster fry. The manner of the taking of said Powder Hole and the determination of the damages sustained thereby, or by any of the doings of the commissioners under the provisions of this resolve, shall be the same as is provided by sections seven and eight of chapter four hundred and seven of the acts of the year eighteen hundred and ninety-three relative to the taking of land by the metropolitan park commission; and said commissioners shall, for the purposes of this resolve, have all the powers conferred upon the metropolitan park commission by said sections. The damages when finally determined shall be paid from the treasury of the Commonwealth to the person or persons entitled thereto. A sum not exceeding one thousand dollars may be expended in carrying out the provisions of this resolve. [*Approved April 21, 1905.*]

[CHAPTER 73.]

RESOLVE TO PROVIDE FOR AN INVESTIGATION AND REPORT BY THE COMMISSIONERS ON FISHERIES AND GAME AS TO THE PROPAGATION OF OYSTERS.

Resolved, That the commissioners on fisheries and game are hereby authorized and directed to make a biological investigation and report as to the best methods, conditions and localities for the propagation of oysters under the conditions found in Massachusetts waters. The commissioners may expend for the purposes of this resolve a sum not exceeding five hundred dollars a year for a period of three years. [*Approved May 12, 1905.*]

[CHAPTER 78.]

RESOLVE TO PROVIDE FOR AN INVESTIGATION AND REPORT BY THE COMMISSIONERS ON FISHERIES AND GAME AS TO THE PROPAGATION OF QUAHAUGS.

Resolved, That the commissioners on fisheries and game are hereby authorized and directed to make a biological investigation and report as to the best methods, conditions and localities for the propagation of quahaugs. The commissioners may expend for the purposes of this resolve a sum not exceeding five hundred dollars a year for a period of three years. [*Approved May 17, 1905.*]

[CHAPTER 93.]

RESOLVE TO PROVIDE FOR A SURVEY BY THE COMMISSIONERS ON FISHERIES AND GAME OF AREAS AVAILABLE FOR THE PROPAGATION OF CLAMS.

Resolved, That the commissioners on fisheries and game are hereby authorized and directed to investigate and determine what areas or localities are, in their opinion, suitable and available for the propagation of clams, and to make a biological survey of such areas. Said commissioners may expend for the purposes of this resolve a sum not exceeding five hundred dollars a year for a period of three years. [*Approved May 24, 1905.*]

[G.]

STATISTICS.

The following tables show the statistics of the shore, net and lobster fisheries of Massachusetts as reported to the commission for the year ending Oct. 1, 1905.

The statistics are divided into three tables, specifying: (1) the number of men employed; (2) the number and value of boats, pound and trap nets, seines, gill nets and fyke nets, lobster pots and shore property; and (3) the number in pounds and value of the different species of fish. As compared with the year 1904, there is a falling off of 30 men, principally in Essex, Barnstable and Suffolk counties. The number of boats, seines, gill nets, and particularly lobster pots, show a falling off in number but a total increased value of over \$8,000; and the total of 17,600,574 pounds of the different species of fish shows a decrease over 1904 of 750,639 pounds, with a decrease in value of \$7,479.86.

TABLE NO. 1. — *Showing, by Counties, the Number of Men employed in the Shore, Net and Lobster Fisheries of Massachusetts in 1905.*

COUNTIES.	Number.	COUNTIES.	Number.
Essex,	106	Nantucket,	30
Suffolk,	18	Dukes,	96
Norfolk,	16	Bristol,	78
Plymouth,	114	Total,	774
Barnstable,	316		

TABLE NO. 2.—*Showing, by Counties, the Apparatus employed in the Shore, Net and Lobster Fisheries of Massachusetts in 1905.*

DESIGNATION.	ESSEX.		SUFFOLK.		NORFOLK.	
	Number.	Value.	Number.	Value.	Number.	Value.
Boats,	140	\$20,814 00	34	\$3,034 00	24	\$3,571 00
Pound nets and trap nets, .	5	7,800 00	-	-	-	-
Seines, gill nets and fyke nets,	172	5,119 00	-	-	-	-
Lobster pots,	2,700	2,895 75	1,960	2,362 50	1,713	2,114 00
Shore property and accessory apparatus,	-	2,030 30	-	160 00	-	298 75
Totals,	-	\$38,659 05	-	\$5,556 50	-	\$5,983 75

DESIGNATION.	PLYMOUTH.		BARNSTABLE.		NANTUCKET.	
	Number.	Value.	Number.	Value.	Number.	Value.
Boats,	163	\$11,907 50	173	\$52,368 00	35	\$8,574 50
Pound nets and trap nets, .	3	3,300 00	92	82,085 00	3	3,000 00
Seines, gill nets and fyke nets,	4	35 00	1,135	8,122 00	276	4,580 00
Lobster pots,	4,705	6,924 00	1,383	1,376 25	230	230 00
Shore property and accessory apparatus,	-	2,511 00	-	15,463 25	-	830 00
Totals,	-	\$24,677 50	-	\$159,414 50	-	\$17,214 50

DESIGNATION.	DUKES.		BRISTOL.		TOTALS.	
	Number.	Value.	Number.	Value.	Number.	Value.
Boats,	123	\$12,895 00	33	\$2,110 00	725	\$115,274 00
Pound nets and trap nets, .	44	20,200 00	1	40 00	148	116,425 00
Seines, gill nets and fyke nets,	3	68 00	16	1,380 00	1,606	19,304 00
Lobster pots,	938	1,144 50	200	225 00	13,829	17,272 00
Shore property and accessory apparatus,	-	1,471 25	-	1,687 50	-	24,452 05
Totals,	-	\$35,778 75	-	\$5,442 50	-	\$292,727 05

TABLE NO. 3.—*Showing, by Counties and Species, the Yield of the Shore Net and Lobster Fisheries of Massachusetts in 1905.*

SPECIES.	ESSEX.		SUFFOLK.		NORFOLK.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives,	70,165	\$919 30	-	-	-	-
Bluefish,	468	31 30	-	-	-	-
Flounders and flatfish,	100	3 00	-	-	-	-
Mackerel,	56,344	3,455 03	-	-	-	-
Menhaden,	48,105	387 86	-	-	-	-
Pollock,	410,349	3,720 07	-	-	-	-
Salmon,	240	17 28	-	-	-	-
Scup,	1,647	69 76	-	-	-	-
Sea bass,	-	-	-	-	-	-
Sea herring,	1,167,689	12,866 93	-	-	-	-
Shad,	15,637	356 46	-	-	-	-
Squeteague,	59,708	1,916 65	-	-	-	-
Striped bass,	-	-	-	-	-	-
Squid,	40,355	429 30	-	-	-	-
Tautog,	305	15 15	-	-	-	-
Other edible or bait species,	911,873	9,443 66	-	-	-	-
Refuse fish,	-	-	-	-	-	-
Oil,	-	-	-	-	-	-
Lobsters,	128,757	17,264 99	76,785	\$9,191 90	64,413	\$9,136 28
Totals,	2,911,742	\$50,896 74	76,785	\$9,191 90	64,413	\$9,136 28

SPECIES.	PLYMOUTH.		BARNSTABLE.		NANTUCKET.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives,	-	-	351,240	\$5,724 67	4,000	\$40 00
Bluefish,	-	-	8,860	539 90	22,135	1,906 94
Flounders and flatfish,	-	-	1,015,548	23,061 06	1,900	57 00
Mackerel,	4,011	\$248 45	451,643	24,007 23	35,365	4,171 00
Menhaden,	-	-	92,900	909 46	-	-
Pollock,	-	-	2,867,210	21,811 04	246,890	4,937 80
Salmon,	-	-	-	-	-	-
Scup,	-	-	33,325	641 34	53,612	1,394 00
Sea bass,	-	-	592	40 42	-	-
Sea herring,	35,400	360 00	743,012	7,861 49	-	-
Shad,	-	-	63,753	1,926 57	5,950	418 00
Squeteague,	32,387	346 87	2,152,873	30,254 42	107,474	3,229 48
Striped bass,	-	-	3,497	479 86	-	-
Squid,	-	-	456,326	4,179 00	240	2 50
Tautog,	1,965	27 65	15,257	347 77	-	-
Other edible or bait species,	10,220	102 00	2,584,900	17,640 44	17,450	853 00
Refuse fish,	-	-	708,104	229 35	700	2 00
Oil,	-	-	-	-	-	-
Lobsters,	280,629	32,352 43	40,884	5,932 86	5,462	823 25
Totals,	364,612	\$33,437 40	11,589,924	\$145,586 88	501,178	\$17,834 97

TABLE 3. — *Yield of the Shore Net and Lobster Fisheries* — Concluded.

SPECIES.	DUKES.		BRISTOL.		TOTAL FOR STATE.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives,	18,200	\$172 00	433,450	\$4,925 17	877,055	\$11,781 14
Bluefish,	485	42 95	—	—	31,948	2,521 09
Flounders and flatfish,	106,193	3,260 96	455	19 64	1,124,196	26,401 66
Mackerel,	13,087	999 10	—	—	560,450	32,880 81
Menhaden,	11,075	182 25	—	—	152,080	1,479 57
Pollock,	45,760	920 20	—	—	3,570,209	31,389 11
Salmon,	1,000	30 00	—	—	1,240	47 28
Scup,	622,159	12,918 62	216	6 48	710,959	15,030 20
Sea bass,	8,358	497 19	—	—	8,950	537 61
Sea herring,	100	1 00	5,000	50 00	1,951,201	21,139 42
Shad,	631	55 15	29,800	1,940 80	115,771	4,696 98
Squeteague,	1,221,993	38,676 22	200	10 00	3,574,635	74,433 64
Striped bass,	—	—	—	—	3,497	479 86
Squid,	17,100	223 00	—	—	514,021	4,833 80
Tautog,	7,970	253 26	2,560	101 20	28,057	745 03
Other edible or bait species,	130,354	656 32	6,504	381 76	3,661,301	29,077 18
Refuse fish,	6,200	4 00	—	—	715,004	235 35
Oil,	—	—	—	—	—	—
Lobsters,	32,459	4,750 80	5,319	836 45	639,708	80,288 96
Totals,	2,243,124	\$63,643 02	483,504	\$8,271 50	18,240,282	\$337,998 69

TABLE NO. 4. — *Comparison, Shore Weir and Net Fisheries, 1904 and 1905.*

SPECIES.	1904.		1905.		GAIN.		LOSS.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alwives,	1,128,921	\$9,548 10	877,055	\$11,781 14	-	\$2,233 04	251,866	-
Bluefish,	60,553	4,050 50	31,948	2,521 09	-	-	28,605	\$1,529 41
Flounders and flatfish,	1,256,643	22,750 22	1,124,196	26,401 66	-	3,651 44	132,447	-
Mackerel,	754,454	46,978 38	560,450	32,880 81	-	-	194,004	14,097 57
Menhaden,	853,270	4,428 57	152,080	1,479 57	-	-	701,190	2,949 00
Pollock,	2,288,900	29,540 92	3,570,209	31,389 11	1,331,309	1,848 19	-	-
Salmon,	16	3 35	1,240	47 28	1,224	43 93	-	-
Scup,	631,867	14,338 99	710,359	15,030 20	79,092	691 21	-	-
Sea bass,	21,790	1,425 69	8,950	537 61	-	-	12,840	888 08
Sea herring,	1,884,123	15,861 63	1,951,201	21,139 42	67,078	5,277 79	-	-
Shad,	72,501	3,051 27	115,771	4,696 98	43,270	1,645 71	-	-
Squeteague,	3,017,786	64,419 29	3,574,635	74,433 64	556,849	10,014 35	-	-
Striped bass,	8,844	1,159 39	3,497	479 86	-	-	5,347	679 53
Squid,	813,839	7,978 41	514,021	4,833 80	-	-	299,818	3,144 61
Tautog,	15,428	312 50	28,057	745 03	12,629	432 53	-	-
Other edible or bait species,	5,435,122	39,020 88	3,661,301	29,077 18	-	-	1,773,821	9,943 70
Refuse fish,	17,800	10 25	715,004	235 35	697,204	225 10	-	-
Oil,	5,200	311 25	-	-	-	-	5,200	311 25
Totals,	18,217,057	\$265,189 59	17,600,574	\$257,709 73	2,788,655	\$26,063 29	3,405,138	\$33,543 15
Net gain,	-	-	-	-	-	-	-	-
Net loss,	-	-	-	-	-	-	616,433	7,479 86

NOTE. — Had the remarkable catch of cod at Provincetown, Chatham, Nantucket and other points from October 15 to December 31 been included, a very considerable increase over the 1904 figures would have been shown.

TABLE No. 5. — *Comparison, 1904 and 1905, Shore Weir and Net Fisheries, Men and Apparatus.*

	1904.		1905.		GAIN.		LOSS.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Men,	478	-	490	-	12	-	-	-
Boats,	398	\$66,404 00	310	\$77,594 50	-	\$11,190 50	88	-
Pounds and traps,	161	106,145 00	148	116,425 00	-	10,280 00	13	-
Seines, fyke and gill nets,	1,897	24,401 00	1,606	19,304 00	-	-	291	\$5,067 00
Shore property and accessory apparatus,	-	18,730 70	-	20,012 25	-	1,281 55	-	-

TABLE No. 6. — *Comparison of Lobster Catch, 1904 and 1905.*

	1904.			1905.			GAIN.			LOSS.		
	Pots.	Lobsters.	Value.	Pots.	Lobsters.	Value.	Pots.	Lobsters.	Value.	Pots.	Lobsters.	Value.
19,539	552,290	\$102,354 53		13,829	426,471	\$80,288 96	-	-	-	5,710	125,819	\$22,065 57

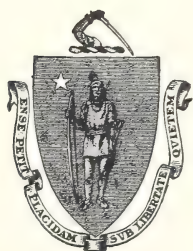
TABLE NO. 7. — *Average Catch of Lobsters per Pot, 1904 and 1905.*

1904.			1905.		
Pots.	Lobsters.	Average per Pot.	Pots.	Lobsters.	Average per Pot.
19,539	552,290	28.3	13,829	426,471	30.8

TABLE NO. 8. — *Comparison of Lobster Fishery for State, 1904 and 1905, Men and Apparatus.*

	1904.		1905.		GAIN.		LOSS.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Men,	326	-	284	-	-	-	42	-
Boats,	471	\$41,573 00	415	\$37,679 50	-	-	56	\$3,883 50
Pots,	19,539	23,648 00	13,829	17,272 00	-	-	5,710	6,376 00
Shore property,	-	4,918 15	-	4,439 80	-	-	-	478 35

REPORT
OF THE
COMMISSIONERS
ON
FISHERIES AND GAME
FOR THE
YEAR ENDING DECEMBER 31, 1906.



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Commonwealth of Massachusetts.

To His Excellency the Governor and the Honorable Council.

The Commissioners on Fisheries and Game respectfully submit this their forty-first annual report.

GENERAL CONSIDERATIONS.

Appropriations. — The amounts appropriated and expended during eleven months of the year 1906 for the various branches of the work covered by your commissioners were, approximately: \$8,500 for the benefit of the sea and shore fisheries; \$6,400 for maintaining the inland fisheries and game, through the purchase, rearing and distribution of food fish, for the rearing and distribution of game birds (pheasants) and rearing ruffed grouse and quail; \$21,000 was expended in enforcement of the fish and game laws, both on land and on the sea coast; \$5,620 for salaries of the commissioners; and \$3,400 for printing, postage, travelling expenses of the commissioners and for clerical and office expenses. The complete and exact details of all expenditures can be found in the report of the Auditor of the Commonwealth.

Since last July we have occupied commodious and adequate quarters in room 158, State House. We have here been able to adjust and distribute the routine work so that more attention can be given to important problems which come to us for consideration. This commission has constantly before it the ideal that it exists not alone for the intelligent and impartial enforcement of law, but that it also has large responsibilities as the accredited official advisers of citizens, corporations, towns and cities, State legislative and executive officials who seek to maintain and develop the natural resources of Massachusetts. It is our single purpose to so use our special training and opportunities as to furnish thoroughly reliable, authoritative and unbiased opinions upon questions of past and proposed legislation, and

of State, municipal or private practices in dealing with fish, mollusks, birds and mammals.

It is greatly to the credit of our State that our legislators in a very large degree examine proposed legislation, not solely from the point of view of their own constituents, but take the broader view that in case of serious conflict of opinions and interests the well-being of the State should be the criterion, rather than of their particular section. Laws extending local exceptions are disappearing. The interest of the State as a whole is paramount in the correct solution of such questions as the lobster and the shellfisheries on the one hand, and the inland fisheries and the game birds and the mammals on the other. The selfish desires or obstructive tactics of local politicians are giving way to a genuine appreciation of a wider civic duty. It is now no longer possible for a legislator to represent his constituents solely; he is compelled by a righteous public sentiment to consider also the claims of other sections than his own.

If the commissioners understand their duty, it is to secure and furnish information and to point out advantageous methods and practices for dealing with fish and game problems; to extend the facilities and enlarge the possibilities of economic gain through a better understanding of nature's laws; to advise, formulate and enforce statutes which promise to yield the greatest good to the greatest number; to act as a clearing house for ideas, a board of conciliation and arbitration in cases of conflicting interests between fishermen, farmers, sportsmen and recreationists upon questions of fisheries and game; and to guard against any untoward attempt of one class of the community to appropriate benefits to itself at the expense of any other section or class. It is not our purpose to seek to curtail liberties, but to point out additional opportunities for profit and recreation.

The Dogfish Problem. — This is one of the most far-reaching questions, involving as it does staggeringly enormous annual damage to our sea fisheries, even to such an extent as to discourage able seamen from following their natural vocation, and thereby impairing the best training school of our great navy. By proper exploiting, the dogfish may be so utilized as to yield

a high-grade fertilizer for the farmers, a valuable oil for manufacturers and possibly additional valuable substances. (A further discussion is given on p. 19.) The bill now before Congress, "to reduce the ravages of the dogfish and to create a market for such fish," should be actively supported by every farmer and every fisherman in the United States, through their Congressmen.

The Lobster. — It is the opinion of this commission that the lobster law should be so modified as to protect *all the adults above the breeding age*, and permit the capture of those best adapted for marketing without directly impairing the source of supply; *e.g.*, permit the catching only of those between 9 and 11 inches long. This opinion is sustained by the judgment of eminent scientific students of biology, as well as by the experience and common sense of practical fishermen. By so doing we would be applying to the lobster the same principle of action — *viz.*, protection of the breeding adults — which has been proved by experience to be necessary in securing an adequate market supply of cattle and poultry, and, indeed, of all domesticated animals and plants. Is there any likelihood that the same principles may not be equally effective in preventing the commercial extinction of the lobster? Massachusetts, Rhode Island and New York, the great lobster markets of the United States, should initiate the measure. (For further details, see p. 96, and also our special lobster report for 1905.)

Shellfisheries. — The work upon the problems involved in the solution of the question of restoring and maintaining the yield of scallops, clams, quahaugs and oysters has made satisfactory progress this year. The problems are intricate and difficult. Their economic importance may be judged from the fact that our experimental beds have demonstrated that by certain inexpensive methods a mud flat which is at present absolutely barren of clams can be made to yield 500 to 1,000 bushels per acre, and that we have in Massachusetts at least 50,000 acres which are to-day producing nothing, but which, if cultivated, might be reasonably expected to yield 500 bushels per acre, giving a probable net profit of \$500 per acre.

Pinnated Grouse. — A disastrous forest fire, coming just at hatching time, prevented any considerable increase in the num-

bers of the Martha's Vineyard colony, which are now the only survivors in the world of this interesting bird. We have maintained a warden on the breeding grounds. We hope to devise some adequate method of preventing a similar disaster in the future. Our personal observations indicate that forest fires and cats have destroyed more of these birds than have the hunters. (For details, see p. 141.)

Pheasants. — During the month of November, under chapter 482, Acts of 1906, upwards of 3,000 male pheasants were killed by sportsmen in the State. This number is exclusive of the number of birds raised in private grounds to be shot by the owners and their friends. Sportsmen report that pheasant shooting is very satisfactory.

Sale of Game. — Massachusetts during the past year felt the wave which is sweeping over the country, and which is destined ultimately to entirely preclude the sale of game birds until certain species can become increased in numbers. The inroads made upon the numbers of game birds by market hunters in this State are still very considerable. Many persons still buy and sell ruffed grouse, quail and woodcock, in direct violation of the law, trusting to the chances of escaping detection, or confident that the large profits will be likely to compensate for the relatively small fine which the lenient court so frequently imposes. The fines in Massachusetts courts for violation of the fish and game laws appear almost insignificant when compared with those imposed for similar offences in other States. (See p. 175.)

Deer. — The forecast which we made last year concerning the number of deer in Massachusetts aroused much interest. The rapid increase of deer has surpassed popular expectations. The damage to crops has been considerable. We know of many persons who have not made their claims for reimbursement, as the law permits, for damages done to growing crops. Some fictitious claims have been detected. The amount paid from the treasury of the Commonwealth from Nov. 30, 1905, to Nov. 30, 1906, was \$2,007. Farm and garden crops, young peach and apple orchards, have in some instances been totally ruined. Simple justice to the farmer should determine that the damage assessed should be based upon the probable market value of the

mature crop. The farmer would thus receive the additional benefit accruing from the elimination of the risk of crop failure and of the cost of marketing. Correspondingly, fictitious representations and fraudulent claims of damage should receive severe treatment.

Trout. — The actual market value of wild trout caught by single hook and line from State waters is not less than \$66,000 annually. Since 1869 this commission has stocked the public waters in all sections of the State. In many instances the effects have been conspicuous; in other streams and ponds the results have not equalled anticipations. It is not too much to say, however, that had no fry and fingerlings been introduced into these waters the fishing to-day would be greatly inferior to what it actually is, and the decline would be conspicuously felt. Even in these days, when every well-known stream is whipped by several fishermen on every holiday, evidences of good strings of trout are frequent.

Nevertheless, it is a fact that under present conditions this Commonwealth is not properly stocking its brooks and ponds. The number of fish put out is not adequate, and the system of distribution to which these conditions constrain this commission is far from economical. (A full discussion may be found on p. 116.)

MARINE FISHERIES.

Protecting Food Fish. — One of the most serious, and withal one of the most complicated and widely permeating, problems is that involved in the question of the degree and kind of protection which must be extended to the marine food fishes, *e.g.*, the mackerel, menhaden, herring, alewife, striped bass, bluefish and other important species, which are not, like the shad, known with certainty to be rapidly approaching commercial extinction, but which nevertheless appear to be in danger on account of the tremendous inroads made by man upon the stock of adult fish.

Man has not yet ceased to regard the ocean as an inexhaustible mine, whence may be taken out frequently, by unrestrained, reckless, wasteful methods, a variety of natural products which can be exploited for gain. The nonmigratory animals and those which appear in definite closely circum-

scribed regions at the same season each year are the first to show the effects. The native oyster has practically been exterminated on the northeast coast. These conditions stimulated men to devise plans for artificial propagation, so that now the oyster industries of Connecticut and Rhode Island far surpass the original fisheries in extent and as a source of wealth. The shad fishery on the Atlantic coast would also have been probably well-nigh entirely blotted out years ago, were it not for the intelligent and successful efforts of the United States Bureau of Fisheries. The lobster, in the immediate regions of the great markets, as a result of ill-advised legislation, is practically gone. Similarly the scallop and the clam require less destructive methods of marketing, and conditions so modified as to attract commercial exploitation.

But most difficult of satisfactory solution are those instances of the migratory fish whose former abundance mislead us in regard to the permanence of the supply, *e.g.*, the bluefish and striped sea bass. From Florida northward these fish are beset with a continuous series of all manner of destructive devices. The southern markets eagerly take the young bluefish under the name of "Tailors," and the young striped bass or "rock," so that in these cases relatively few individuals are nowadays left for the drailers of Buzzards Bay and Vineyard Sound, or for the rod and reel fishermen in the mouths of the rivers or on the rocks of Cuttyhunk.

It is, too, a grave question whether we are not using the wrong fish for fertilizer and oil. The menhaden is one of the fishes best adapted to serve as food for the larger and more valuable food fishes, and without doubt the presence of menhaden attracts the larger fish. The menhaden schools seek the shores, particularly the bays and estuaries, to spawn and to feed; consequently the larger game and food fish follow, and there is a chance for sport, and for profit for the traps and the fishermen. The menhaden, therefore, must be classed as a useful fish when alive. The vast bulk of those caught are turned into fertilizer and oil. The fertilizer made from menhaden is probably of no greater value than fertilizer made from less valuable fish, such as the dogfish, or from fish waste. The oil is without question better than dogfish oil for certain special

purposes; but dogfish oil can be substituted for many of the purposes for which menhaden oil is now used. If, therefore, the menhaden fishery could in any degree be diverted to rendering the dogfish into oil and fertilizer, there would be a tremendous benefit to the commercial fisheries, notably that for the mackerel, cod and other bottom fish; for the dogfish drive and destroy other fish, instead of attracting them as do menhaden. (For an opinion upon the damage done by dogfish, see p. 19, and also the special report of this commission for 1905.)

If it were possible to devise some workable scheme by which the menhaden steamers could collect on the fishing grounds the dogfish taken on the trawls, and transport them directly to the factories, there to be rendered into oil and fertilizer, a great benefit would result to all who follow the sea as fishermen, as well as to those whose only interest in the fisheries is as the consumer who pays the price.

"Fisheries Trust." — All sorts of rumors concerning a proposed fisheries trust have been current during the autumn months. A similar project failed a few years ago. There can be little question that the fishing industry is to-day in a rather unsatisfactory condition, — unsatisfactory to the public, on account of high prices and often unsanitary methods of handling the fish between the water and the consumer; unsatisfactory to the fishermen, because all species of fish which come to hook cannot be profitably disposed of in the market; unsatisfactory to the owners of vessels, because vessel property is frequently not a paying investment, as compared with other properties, in these days of prosperity on land; unsatisfactory to the wholesalers, for the reason that expenses multiply. Even the most casual observer of conditions at T wharf could not fail to observe that the facilities for handling fresh fish are grossly inadequate for rapid, economical and even sanitary handling of the enormous quantities which may come to market. That the work is as well done as it is to-day speaks volumes for the ability, knowledge and energy of the wholesalers at T wharf. A heavy catch at the present day causes low prices only on account of lack of proper facilities for distributing the product. A combination might secure better organization, whereby better

prices could be paid to the fishermen, with better goods and lower prices to the consumer and greater profits to the dealer. There should follow a more scientific handling of the catch, and thus a more careful husbanding of nature's bounty, particularly through the more even distribution of the demands upon certain species of food fishes. It is suicidal to relentlessly pursue certain species, such as the mackerel, both as young and as mature fish, and at the same time neglect to assist the mackerel by reducing by every known device the enemies (dogfish and other sharks) which specially prey upon the schools of fish, as well as causing great damage to the gear of the fishermen. Increased attention should be given also to the relative economic values of fish. Too frequently we commit the biologic blunder of using the wrong fish for fertilizer, thus destroying fish which naturally serve as food for more valuable species, and neglecting the predatory species, which prey upon those fish which bring the best prices in the markets.

Steam Trawling. — As bearing upon the still unsettled question as to the value of the steam otter trawl method in North American waters, the following news item, from the "Fishing Gazette" for Dec. 15, 1906, is of interest: —

So far from being a flat failure, the dried-fish merchants of northern France believe that steam trawling will yet save the decaying industry at St. Pierre, Miquelon. They are going to send over forty steam trawlers this next year to engage in the bank fishing, and naturally the St. Malo amateurs and the St. Pierre fishermen are making common cause with the Nova Scotian and Gloucester fraternity against the innovation, alleging disaster, etc. It is, however, very significant to note that in the face of so much discouragement a number of hard-headed practical business men think enough of the venture to engage in so large an expenditure. Of course the French fishermen get a bounty on their fish, but that alone would not justify any such investment as that now contemplated. The outcome will settle the fate of trawling for all time in North Atlantic waters.

Damage by Seals. — Very little is known concerning the damage to our fisheries by seals. The contents of the stomachs of five seals, taken on Fawn Bar in the night of July 9, were examined by Frank Serrilla on the morning of July 10, with the following results: —

Seal No. 1.—Had 9 eels; 4 measured about 2 feet each in length, the other 7 measured about 20 inches each. Also had about 2 quarts of small herring; half of this was semi-digested into a mash. Seal weighed 275 pounds.

Seal No. 2.—Had nothing but smelts, about $\frac{1}{2}$ peck, one-third of smelts measuring from 3 to 6 inches in length; rest were very small, and, being semi-digested, impossible to count.

Seal No. 3.—This seal weighed about 475 pounds. Had 4 large flounders and about $\frac{1}{2}$ peck of very small herring; about two-thirds of it was so far digested that it was impossible to count.

Seal No. 4.—Weighed about 300 pounds. Had large and full stomach of small mackerel; about two-thirds of these mackerel were semi-digested into a mash; each mackerel measured from 5 to 6 inches in length.

Seal No. 5.—This seal was very small, weighing about 120 pounds. Had something in its stomach that looked like milk.

Statistics upon Boston and Gloucester Fisheries.—Shack fishing still develops, but unfavorable weather and dogfish have this season been serious handicaps.

The total weight of fish of all kinds landed at Gloucester was 93,816,284 pounds, as compared with 112,459,818 pounds in 1905. It is estimated that Gloucester vessels at other ports landed 34,271,000 pounds, as compared with 44,560,000 pounds in 1905.

The total number of fishing craft coming to Boston in 1906 was 385. Of this number, 270 were vessels and 115 boats of various kinds, — gasolene boats, launches, etc. The number of trips made in 1906 was 4,505, compared with 3,832 in 1905 and 4,056 in 1904. There were 89,693,370 pounds of fresh fish landed in Boston during 1906, — 4,555,560 pounds less than during the record year of 1905. Though the largest decrease was in the pollock catch, a decline also appeared in the case of haddock, hake and cusk. There was a gain of about 2,500,000 pounds in the cod and of about 23,000 pounds in the halibut catch. Pollock shows a remarkable falling off; the catch was less than one-half of that of 1905. This is more conspicuous, since it follows the year of the greatest pollock catch on record.

The catch of Gloucester vessels is given in the following table:—

CATCH OF GLOUCESTER VESSELS.	1906.		1905.		1904.	
	Barrels.	Pounds.	Barrels.	Pounds.	Barrels.	Pounds.
Salt cod,	—	18,387,800	—	18,139,000	—	22,514,600
Fresh cod,	—	8,550,700	—	11,281,060	—	11,564,000
Halibut,	—	3,442,400	—	2,324,700	—	1,970,000
Haddock,	—	14,095,100	—	13,694,190	—	7,274,000
Hake,	—	5,437,910	—	13,517,315	—	11,342,400
Cusk,	—	4,021,900	—	6,895,830	—	4,128,200
Pollock,	—	7,314,400	—	17,637,535	—	8,964,400
Filched halibut,	—	582,935	—	453,578	—	742,000
Fresh mackerel,	1,969	383,800	2,284	456,800	3,240	648,000
Salt mackerel,	10,999	2,199,800	26,050	5,210,000	25,053	5,010,600
Fresh herring,	12,084	2,416,800	7,257	1,451,400	8,735	1,747,000
Salt herring,	67,771	15,451,788	38,350	8,743,800	74,097	16,894,116
Frozen herring,	25,389	5,077,800	27,752	5,550,400	22,825	4,565,000

Swordfish,	-	3,001	-	23,240	-	121,000
Cured fish,	-	3,496,950	-	4,754,370	-	3,436,608
Frozen squid,	-	-	-	-	-	-
Porgies,	225	45,000	1,226	245,200	1,636	327,200
Halibut fins,	270	54,000	217	43,400	252	50,400
Whiting,	6,000	1,200,000	4,200	840,000	3,000	600,000
Shad,	931	186,200	40	8,000	380	66,000
Salt alewives,	-	-	-	-	-	200,000
Fresh alewives,	-	-	-	-	-	76,000
Fresh fish from boats,	-	1,000,000	-	900,000	-	600,000
Miscellaneous,	-	468,000	-	400,000	-	800,000
Total landed at Gloucester,	-	93,816,284	-	112,569,818	-	103,641,524
Total landed by Gloucester vessels at other ports direct (estimated),	-	34,271,000	-	44,650,000	-	31,776,000
Total landed at Gloucester and by Gloucester vessels at other ports,	-	128,087,284	-	157,219,818	-	135,417,524

Market Fishermen, Shore Boats. — The high liner this year, as last, is the schooner "Mary C. Santos," Capt. Manuel C. Santos, which stocked \$36,000.

Schooner "Mary E. Conney," Capt. Frank Conney: stock, twelve months, \$32,389.80; crew, 14 men, share each \$1,138.07.

Schooner "Walter P. Goulart," Capt. Antone P. Goulart: stock, twelve months, \$30,875.35; crew, 14 men, share each \$1,109.45.

Schooner "Maud F. Silva," Capt. Manuel Silva: stock, twelve months, \$29,867.35; crew, 14 men, share each \$879.65.

Schooner "Sadie M. Nunan," Capt. Frank Nunan: stock, \$26,955.

Schooner "Belbina P. Domingoes," Capt. E. Domingoes: stock, \$25,600.

Schooner "Benj. F. Phillips," Capt. Michael Powers: stock, \$21,000.

Cod. — In general, the successful cod fishery of last year has been maintained this season, though there was a decrease of about 2,500,000 pounds in fresh cod taken by the Gloucester fleet, and a small increase of about 260,000 pounds of salt cod, making a total decrease of less than 7 per cent. The high prices, however, made "a fair year" for the fishermen.

The winter shore cod, haddock and pollock fisheries have been remarkably good for the past two years, daily catches often averaging 400 to 500 fish per boat. This remarkable abundance of cod on the Massachusetts shores is ascribed to the beneficent work of the Woods Hole and Gloucester hatcheries of the United States Bureau of Fisheries.

Reliable data upon the average catch per vessel is of considerable value for indicating the condition of the fisheries, though it is by no means a sure indication of the abundance or scarcity of fish, for beside this factor it includes the results of improved methods of catching, better-equipped vessels, time consumed in securing bait, etc. The average trip of the Gloucester salt bankers was 189,618 pounds for this year, as compared with 186,693 in 1905 and 162,000 in 1904. This is the fleet which it was claimed would be greatly handicapped by the restriction to the treaty coast of the baiting privilege in New-

foundland. The actual results do not seem to indicate this, but rather that to be compelled to provide bait elsewhere has proved a decided advantage to the vessel owners, on account of the diminished risk connected with navigating the rocky shores of Newfoundland in search of bait, the money saved by securing cheaper baitings, and the economy of time through the necessity of more careful preparations for securing bait. Of more serious import to the Newfoundland fishermen is the loss of opportunity to change Newfoundland herring and caplin into United States money.

The uncertainties connected with the pure food laws has militated somewhat against the marketing of the usual quantities of prepared fish; but now, with uniform legislation, the outlook is most satisfactory for even greater demand for these products. One of the leading fish merchants of Gloucester says, in this connection:—

As compared with the records of the fleets of 1904 and 1905, there is a falling off of over a million pounds, the cause of this being the smaller number of vessels making one trip instead of two in the season. The average catch per vessel shows a large increase over 1904 and a perceptible increase over 1905.

No vessels were lost in this fishery the present season, but several fatalities resulted from going astray from the vessels in dories and being capsized while hauling trawls. In the latter list several were lost in one day, a very rough one, while fishing off Cape North, early in the season. A few accidents were recorded to the vessels of the fleet, caused principally by going ashore in entering or leaving port and in riding out heavy gales of wind on the fishing grounds. One vessel, the schooner "American," lost her whole string of cable, and had a very close call from being lost with all hands on Sable Island, but was saved by good seamanship and the windward-clawing abilities of this old-style craft.

This is the second season since Newfoundland withdrew the license and bait privileges of her coast to the American fleet, the action affecting all her water front excepting the treaty coast. At the time the island colony took this step, Newfoundland government officials and many newspapers there, as well as some in this country, loudly blazoned the prophecy that this meant the downfall of and finishing blow to the New England salt bank codfishing industry, for the reason that all the American bankers, debarred from securing bait at their ports, would be helpless the larger part of the season to secure any elsewhere, and thus be obliged to give up the business. Many reciprocity shouters

and journals in this country took up the cry, and said it was another reason why the Bond-Hay treaty should have been enacted. All this was before the fleet of 1905 had fairly got started from home.

When the 1905 season was completed, it was found that the fleet had landed only 548,000 pounds less than in 1904, when the New England fleet had the free run of Newfoundland ports for the securing of bait. Not only this, but the statistics of the season showed that, from an average catch per trip in 1904 of 162,000 pounds, there had been an increase in 1905 to 186,693 pounds per vessel, it being borne in mind, with this fact and the amount of fish landed, that the size of the fleets of 1904 and 1905 were the same, thus affording a fine chance for comparison.

At the close of the 1905 season, many of the prominent and well-posted captains of the salt bank fleet were interviewed regarding what effect the closing of their ports to us for bait for our vessels had upon the fleet for the season then just closed. Many of them affirmed that it had helped rather than hindered, and others said that they were just as well off as ever they were before the bait-buying privilege was taken away. These statements they backed with facts and figures, all of which appeared in the "Times" at the time.

They contended that they did not waste as much time at harbors and ports of Newfoundland seeking for bait, when, had they stayed in the fishing grounds, they might have grubbed up enough to have done some fishing all the time. They instanced, in contradiction to the Newfoundland claim that she had all the bait all the time, case after case of vessels being from three to six weeks at her harbors and ports in search of bait, without being able to secure any; while vessels that had stayed out had picked up some, and kept on fishing.

They claimed, also, that they were better off financially, as their baitings taken elsewhere had not cost nearly as much as when taken at Newfoundland in 1904 and previous years; and that besides this they had caught much of their own bait with little difficulty, up off newly discovered spots near Greenly Island and other places on the coast of Labrador on the Gulf of St. Lawrence side. Also, they claimed, there had been less accidents to vessels in the fleet, as they were not obliged to keep going from harbor to harbor in search of bait, and that consequently there was less liability of danger of stranding and striking rocks, and thus perhaps losing a whole trip.

After the season closed and the facts were given out, the supporters of Newfoundland's action both at home and in this country claimed that one year proved nothing, and said, "Wait another year." That other year has been finished, and its results justify the skippers of the fleet, it not changing their minds regarding anything they said at the close of the 1905 season. Many of them reaffirmed, and said they were now more sure they were right than ever before. They pointed to the

fact that they had not been bothered for bait throughout the season, and had even increased the average catch per trip.

The falling off in the total catch from 1905 they ascribed to the almost unprecedented scarcity of fish and smaller number of vessels engaged. This, of course, is known to all interested in the fisheries in general, for the scarcity was not confined to the New England fleet, but extended to the fleets of the French and Nova Scotia, and even to the Newfoundland fleet, with its much-boasted exclusive bait advantage. As is well known, bad weather at the start of the season had much to do with the falling off of the catch.

Bad weather and an unusually poor fishing on the Peak gave many of the vessels a poor start; and after fresh bait in plenty was taken at the Magdalene Islands, the fleet ran up against another snag in the shape of the hardest kind of fish weather, and absence of the usually big codfish schools off Cape North. These things, of themselves, account for the falling off in the catch of the local fleet, which afterwards did well in the Gulf of St. Lawrence, off the Labrador coast, near Greenly Island and on the Flemish Cap, but at the end of the season struck poor fishing again.

Two seasons, then, have passed and figured up since Newfoundland deprived our vessels of the privilege of buying bait at her ports; and it would seem by this time that it had conclusively been proved that the action has in no way handicapped the American salt bank fleet, let alone given it the finishing blow or caused its downfall. The fleet has gone along about its business, and has done as well as ever and at smaller cost. All of which goes to show the truth of the oft-repeated expression, that no country or no one set of men can control the deep-sea fisheries.

As far as prices go, the season did not open extra big, but gradually rose so that it was one of the best for a great many years. The first fares home brought \$3.25 per hundredweight for large and \$2.25 for medium, the highest for first or spring trips being \$3.30 for large and \$3.37½ for medium. Early in September, when the single-trip vessels began to come along, the price started at \$3.50 and \$2.62½, but was soon at \$4 and \$3, and finally sold as high as \$4.35 and \$3.50. The vessels on second trip began to come home in the latter part of October, the first and most of them selling for \$4.50 and \$3.50, some of the last ones getting \$4.75 and \$3.75, — the highest price of the season for salt trawl bank cod.

The early dory handliners sold for \$3.90 and \$2.90 about the middle of September; but those coming along in November got \$4.75 and \$3.75 for their trips; and schooner "Lizzie Griffin," which was the last dory handliner, as well as the last vessel of the whole salt bank fleet to arrive, coming in December 3, sold to Cunningham & Thompson at the unprecedented price of \$5.25 and \$4.25 for large and medium, — the

top-notch price of the season for any kind of salt fish, and also believed to be the highest price ever paid for a fare of salt bank codfish.

This year we do not face such an uncertainty, and a more regular business is anticipated throughout the year. It is found that fish food products are pure, healthy, and packed with the utmost care and neatness. Fish have been the staple food of people since the world began. There will always be a business in catching fish and in selling them. Old Jerusalem had its fish gate, and Gloucester for years to come will have its fish receipts gate in a beautiful harbor to receive the ocean catch, and its outlet by its water and iron gate in sending the products away.

Salt Bank Fleet Stocks, 1906. — Schooner "Tattler," Capt. Alden Geel: started in April; last trip landed November 7. First trip, pollock, seining, \$5,241.83; second trip, dory handlining, \$13,168.47; total, \$18,410.30. Share: first trip, \$118; second trip, \$226; for season, \$344. On the second trip, the high-line man shared \$339.26. Catch of fish: first trip, salt pollock, 344,000 pounds; second trip, salt cod, 315,800 pounds; total catch of fish for season, 659,800 pounds. This was the high liner, and on her second trip made the biggest stock ever got on a dory handline trip.

Schooner "Aloha," Capt. John McInnis. First trip: stock, \$5,264.54; share, \$80.10; fish, 215,000 pounds. Second trip: stock, \$11,665.67; share, \$236.02; fish, 287,000 pounds. Season's stock, \$16,930.21. The first trip was trawling; the second was dory handlining. Started in February; last fare landed November 17.

The last vessel of the salt bank fleet to arrive was the schooner "Lizzie Griffin," of Orland, Me., a dory handliner. She came here from her second trip December 2, with 80,000 pounds of salt cod. The fare sold to Cunningham & Thompson at \$5.25 and \$4.25 per hundredweight for large and medium, believed to be the highest price ever paid for salt cod.

Schooner "Independence II.," Capt. Joseph V. Cusick: started in March; landed last fare October 24. First trip, 261,000 pounds; second trip, 228,000 pounds; total, 489,000 pounds. The stock was almost \$16,000. Both these trips were salt trawling trips, and this was the best stock of the season for a vessel making two salt trawl hauls codfishing trips.

Halibut. — Notably, in the case of halibut a large fleet is of advantage in locating the fish; and consequently the catch of a large fleet is proportionately greater, for the reason that the fish are followed more closely. From a catch of 6,000,000 to 8,000,000 pounds of Atlantic fresh halibut the catch sank to less than 2,000,000 pounds; but during the past two seasons, with an increased number of vessels, the average catch has nearly doubled this year, showing a gain of more than 1,000,000 pounds over 1905. There are indications of a still larger fleet for the season of 1907.

Mackerel. — Despite the fact that the early April rush for mackerel on the southern fishing grounds was the largest fleet ever known on this coast, comprising, as it did, over 100 sail, including 50 Gloucester vessels, 22 from Boston and the remainder from other ports, the catch of mackerel with one exception is the smallest on record since the fishery began in 1814, when but 1,339 barrels were taken. In the palmy days of genuine mackerel catching, the early 80's, it exceeded 200,000 barrels. From 1839 to 1854 mackerel were scarce, for some unexplained reason, but probably from natural causes, as man and his seine did not then, as now, figure so prominently in all parts of the world. The mackerel netting by the small boats from shore was almost a total failure.

The first mackerel catch was landed by Capt. Sol Jacobs, at Norfolk, Va., on April 2. Though small, they brought a fancy figure in the New York market.

The "Fishing Gazette" for May 19, 1906, says:—

What few barrels of salt mackerel the seiners brought in from the south were cleaned up on this market at \$9 per barrel; the fish count about 400 to the barrel.

The southern seining business has been a disappointment this season. Out of a large fleet of vessels, probably not over a dozen have paid expenses. In fact, taken as a whole through a term of years, spring seining out south has been a losing venture; and yet every season finds captains and crews eager to take chances of being a high-liner. It is the occasional vessel that shows a large stock, and there are some whose catch is big enough in a few weeks to insure expenses for the entire season; but the great majority return with a balance of loss against them.

In June last a series of special fish trains was inaugurated, bringing mackerel, lobsters, etc., from Canso and other ports of the Provinces to Boston, *via* the Dominion Atlantic Railway and the Yarmouth steamer. The first train consisted of 9 car-loads of fish.

Haddock. — The favorable weather last winter permitted the catching of unheard-of quantities of haddock. Early in the year the market was frequently glutted with fresh haddock and other fish; consequently, the total for the year at Gloucester again sets a record mark, rising 14,000,000 pounds, — a small increase over last year, and practically twice that of 1904. Of fresh haddock at Boston about 5,000,000 pounds less were used in 1906 than in the year preceding.

Whiting. — The utilization of this fish at Gloucester is rapidly increasing, this year amounting to 6,000 barrels, as compared with 4,200 barrels in 1905 and 3,000 barrels in 1904. Mr. Atkins Hughes of North Truro reports: —

The catch of whiting the past year was more than 1,000,000 pounds, at a value of \$5,000; 500,000 pounds of these have been frozen and sold to be delivered in the winter months. Not more than five or six years ago we should have had to turn them out of the weirs as worthless.

Herring. — The herring business is rapidly developing, making a profitable industry during the season when other fish are in light demand. Gloucester now handles 50,000 to 70,000 barrels of salt herring alone.

As indicating the close interrelation between fisheries of different species, the following is quoted from "Lloyd's Weekly News" (London): —

Herring fishing at Shetland is now drawing to a close for the season, and except at Lerwick the results, as compared with last year, have been very disappointing.

The cause of the failure is generally attributed to the prosecution of whale fishing on the Shetland coast by Norwegian companies. The government are to be petitioned to stop or regulate the fishing of whales from Shetland, in the interests of the thousands of fishermen, workmen and curers; and a successful meeting of protest has taken place at Lerwick. As showing the extensive operation of whaling at Shet-

land, it may be pointed out that no less than 598 whales have been captured this season, while the total for the four years during which the companies have been whaling is 1,553.

A writer in the London "Globe" says: —

France claims to have at last solved the problem of the Breton sardine fishery. The crisis which has spread such misery in the province was not caused by the disappearance of the shoals, but by their non-appearance from the lower depths, simply because the fishermen had not the only really effective bait for attracting them. This consists in the spawn or "eggs," of codfish, which are prepared only in Norway, and sold at the monopoly price of nearly £6 per barrel. As the Breton fisher folk could not afford such a price, they have used inferior substitutes, which have reduced them almost to famine. But at last M. Fabre Domerque, inspector-general of French fisheries, has come brilliantly to the rescue by devising an artificial production of cod's "eggs." This artificial product is identical in size, color and odor with the natural "eggs," from which it is quite indistinguishable. Thrown into the water, it is ravenously sought by fish in shoals. M. Domerque has taken out a patent, but he has placed it in the hands of the Minister of Marine, so that French fishermen may now have their bait at about a quarter the price asked in Norway.

A Berlin paper tells of a new device that makes herring fishing easy. A microphone, which magnifies sounds, is plunged into the sea, to ascertain if fish are passing in that vicinity. A wire connects the submerged microphone with an ordinary receiver, with which one listens to what is going on in the depths of the sea. Excellent results are said to have been obtained in the North Sea by this invention for signalling the passing of the herring schools. Wireless telegraphy has already been put to practical use in marketing the catch.

Dogfish. — The dogfish question is one which concerns not alone the fishermen, but effects of the damage done by these and other sharks extend directly or indirectly to every State in the Union and to every nation on the globe. Briefly stated, the situation is this. It has been a well-nigh universal practice, either as a matter of custom or as conforming to local market preferences, to confine the fisheries to a relatively few species, notably the mackerel, cod, salmon, bluefish, striped bass, etc., and to throw overboard, either alive or dead, such fish as

did not readily and without exploitation meet the market demands. Thus we have gone on for generations killing both the adults and the young food fish of the fashionable species, and without question we are beginning to see evidences of a decline in certain instances. In some cases the decrease is local, but in others it is general. Thus, although we have impaired the reproductive capacity of certain species by killing a stupendous quantity of both old and young individuals, *e.g.*, the mackerel, we have done nothing to check the increase of the natural enemies of these fish, such as the dogfish and other sharks. Thus the dogfish has come to be proportionately more numerous, and the relative number of food fish destroyed by dogfish is correspondingly greater. As a result of our investigations last year, we found that apparently at least 50 per cent. of the total weight of fish caught were dogfish, as nearly as we could determine. In addition to the time lost in hauling up and liberating these dogfish, and the loss of opportunity to catch marketable fish on the hooks occupied by dogfish, the total actual annual cost of catching them amounts to at least \$160,000; besides this, the damage to fish on the hooks and in nets eaten by dogfish is at least \$250,000. Further than this, at a fair estimation every dogfish which reaches mature size, say 5 to 7 pounds, will have eaten at least 20 pounds (and undoubtedly more) of marketable fish. Massachusetts fishermen catch annually at least 27,000,000 dogfish, which must have eaten 540,000,000 pounds of marketable fish, which, even at 1 cent per pound, figure up an annual damage in Massachusetts waters alone of between \$5,000,000 and \$6,000,000. A corresponding tribute is laid by the dogfish upon the fisheries of Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, the Carolinas, Georgia and Florida, as well as upon the Pacific coast. But even worse does this burden press upon the fisher folk of the British Maritime Provinces. The people of Massachusetts have felt this burden. The Legislature appropriated \$2,000 for investigating the damage done to the Massachusetts fisheries by dogfish and other sharks. The results were embodied in our fortieth annual report (1905).

The people of Massachusetts believe that this question is worthy of the most earnest consideration by Congress. A bill

was introduced in Congress, which, though in general appearing to meet the conditions, yet embodied certain impracticable features, viz., extermination, etc.

On February 8 His Excellency Governor Guild appointed a committee to advocate national legislation upon the dogfish question, for the benefit of the fishing interests and of the fish-purchasing public. The Hon. Heman A. Harding, chairman of the legislative committee on fisheries and game, represented Cape Cod, Bristol and Plymouth counties; and Ex-Representative Edward C. McIntire represented the interests of Suffolk and Essex counties. The chairman of the Massachusetts Commission on Fisheries and Game was designated as the chairman of the delegation.

The hearing was held before a sub-committee of the committee on the merchant marine and fisheries, with Hon. W. S. Green of Massachusetts as chairman. The special delegation from Massachusetts called attention to the actual damage done not only to the Massachusetts fisheries, but also to those of the British Maritime Provinces, of Maine, New Hampshire, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, Virginia, the Carolinas and Florida. In their opinion, the increasing dogfish pest was one of the most prominent factors in the decline of the fishing interests, and the withdrawal of capable men to other pursuits. Such a condition is not alone deplorable on economic grounds, but is an actual menace to the efficiency of our navy, through the increasing difficulty of securing trained seamen. The nursery of the navy is threatened. The question was supported by officials of the Department of Agriculture, who testified that the farmers needed the additional source of nitrogenous fertilizer, which can be secured from utilization of the dogfish, and therefore the bill deserved support from the farming interests of the entire country, as well as from the fishermen on both the Atlantic and Pacific coasts. Dr. H. M. Smith, of the United States Bureau of Fisheries, detailed the work of the Bureau upon the dogfish problem, and expressed the opinion that: —

The ravages of the various species of dogfish on our coasts have become very serious, and in some sections are a distinct menace to the

welfare of the fishing population. The direct damage done to our fisheries by these fish amounts to many hundreds of thousands of dollars annually, while the indirect injury to the industry, due to the destroying, harassing and driving away by dogfish of valuable food fishes and other products, is many times greater. Owing to the entire absence of a market for dogfish, the fishermen are placed at a decided disadvantage, and will probably never be able, unaided, to ameliorate the condition; but if the dogfish can be shown to have an economic value, and a way of utilizing them can be made known, the fishermen will be able to hold them in check, the regular fishing will be improved, and new products of value will be placed on the market.

The question was ably supported by Representative C. Q. Tirrill, who introduced the original dogfish bill; and by Representatives A. P. Gardner and Wm. S. McNary. As a result, the following bill was prepared, upon which all interests appear to be agreed:—

A BILL TO REDUCE THE RAVAGES OF THE DOGFISH, AND TO CREATE A
MARKET FOR SUCH FISH.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Bureau of Fisheries be, and is hereby, authorized and directed to conduct investigations and experiments having for their object the mitigation of the damage done the fishing industry on the coasts of the United States by dogfish.

SECTION 2. That the procedures under the foregoing section shall consist: (1) in determining the most effective methods of reducing the numbers of dogfish and of capturing them in wholesale quantities; (2) in demonstrating the economic value of dogfish as a source of fertilizer, oil and leather, and the most suitable methods of utilizing them for such purposes; (3) in testing the usefulness of the dogfish as food when used fresh, or prepared by salting, smoking and canning, and in developing the domestic and foreign markets for such preparations; and (4) in such other inquiries, investigations and experiments as the commissioner of fisheries may deem desirable for the purposes of keeping the dogfish in check, of providing a ready and profitable market for the dogfish now incidentally caught, of inducing fishermen to engage in the dogfish fishery, and of converting a now worthless and destructive animal into a valuable commodity.

SECTION 3. That the sum of twenty-five thousand dollars, or as much thereof as may be necessary, be, and the same is hereby, appropriated for enabling the bureau of fisheries to carry out the foregoing provisions.

SECTION 4. That as soon as practicable after the passage of this act the commissioner of fisheries shall cause the necessary investigations and experiments to begin and be actively prosecuted, and that he shall on conclusion thereof make a full report to congress.

In addition to the statements above made as to the damage to the fisheries, more specific cases of the damage to other allied industries can be shown:—

As a result of the investigations carried on by the United States Bureau of Fisheries, it was found that “the smooth dogfish feeds principally on large crustaceans, nearly all of which are of direct economic value, conspicuous among which is the lobster. Estimating the number of smooth dogfish in Buzzards Bay as 100,000, which is conservative, and allowing each dogfish one lobster in three days, there would be represented a destruction of 150,000 lobsters in one month, or 750,000 during the five months of the presence of the dogfish in the region.”

The Dominion government, in addition to the establishment of three rendering plants for converting dogfish into oil and fertilizer, is actively urging the possibilities of using dogfish as food. The “Fishing Gazette,” editorially, says:—

The Ocean Fish Company of Halifax are meeting with success in introducing canned dogfish, under the name of “ocean whitefish.” The stock has been subscribed for in many cases by fishermen who have severely felt the depredations of these pests. The fish are put up in attractive packages, and meet with a ready sale in Canada and England. The high duty on canned fish in the States makes it prohibitory for the company to sell the fish here. Although there is a market for them, the duty, etc., of \$1 per case prevents the dealers from handling them. The United States government should encourage in some way the canning of these fish, for it would help to exterminate them. We feel sure they could be sold in large quantities here if placed on the market at a price to compete with other canned fish. They are very palatable, and would soon become popular. An attempt to can them was made in Canada some years ago. When everything was ready to place them on the market, they disappeared for sixteen years. They made their appearance about ten years ago. Perhaps with the advent of a factory in this country, with that of Canada, it would be a signal for them to migrate again. If such proved the case, it would be well to experiment again, even at the expense of building factories, in which case both governments could well afford to reimburse the companies for their losses, etc.

Consul Stephens, at Plymouth, Eng., says: —

The Cornwall sea fisheries committee have recently indorsed the favorable verdict previously given at Plymouth as to the edible qualities of dogfish, and no doubt their approval will give a further stimulus to the consumption of this once despised fish. The committee also approved of the new name given to the fish, namely, "flake," the general acceptance of which, indeed, may now be said to be assured. Whereas only a few months ago complaints were made of the ravages committed by apparently inexhaustible shoals of dogfish, the fishermen now complain that they cannot get enough "flake" for the market. They hope for their speedy return. Preparations are being made for better equipment in the way of nets and gear for the next season. The railway charges for "flake" have already been reduced from Plymouth to the great centers of population.

Dogfish Eggs. — One of the most conspicuous features when dogfish are "livered" are the considerable quantities of eggs which drop out when the body is split. (See article on dogfish, in the fortieth annual report of this commission.) These, except for the color, which is a pale yellow, even straw color, have the appearance of the yolks of hens' eggs. The government analyst to the English Board of Agriculture and Fisheries has made a report upon the nutritive and commercial value of dogfish eggs. He says that "the appearance when boiled is similar to that of an ordinary hard-boiled egg," though the yolk is of a cream color. It has a pronounced fishy flavor and odor. In cases where such are not objectionable, "the eggs would undoubtedly prove a wholesome and highly nutritive food." It is possible that treatment with superheated steam might modify this flavor and odor. In addition to their use as an article of food, he suggests the use of the egg for certain branches of the calico-printing trade and in the dressing of certain fine leathers. The oil may be extracted and used for currying and leather dressing. "It could be used for making soft soap, and in a refined and purified form it might possibly prove as useful medicinally as cod-liver oil."

Winter Herring. — This annual venture to Newfoundland waters means much to the herring market of the United States, but more to the fishermen of the treaty coast. The past season

has been especially hazardous, not alone from the conflicting interests involved, but also from ice and severe storms. It is a matter of most cordial congratulation that local friction resulted in no untoward actions, and that justice and common sense prevailed. The returning fishermen report that the presence of Hon. A. B. Alexander of the United States Bureau of Fisheries and of Lieutenant Hinds with the United States tug boat "Potomac" were of extreme value to them. Capt. C. C. Young well voices the opinion of all when he says that Mr. Alexander, "with his great knowledge of the state of affairs, and the cool-headed, dauntless Lieutenant Hinds, with his dash and ability, were the means of turning what looked to be one of the hardest herring seasons on record into one where the vessels had a chance to fish and to take advantage of the greatest run of herring Bay of Islands ever saw." The good offices of the "Potomac" and those with her were extended in every possible direction for the well-being of all, not alone for the "Yankees," but also for the Nova Scotians and Newfoundlanders. "All were treated alike," and all vessels, of whatever nationality, were cut out of the imprisoning ice without discrimination. Captain O'Reilley of the Newfoundland cutter "Fiona" performed his official duties with extreme consideration and good judgment, and in addition rendered notable service to all the fishermen, whether Newfoundlanders, Canadians or Americans. Captain Young, speaking of the "Fiona" and her commander, Captain O'Reilley, says: —

They worked, bucking the ice, until the copper was cut through, and then were sorry they had to stop. More than this, Captain O'Reilley seemed to put himself out to do all the favors he could. He carried, as did the "Potomac," dispatches back and forth, and, like the "Potomac," never left the fleet without first inquiring for messages, letters and sick men, etc., to be sent to Birchy Cove.

St. John's "Trade Review" says: —

The Gloucester fishing interests claim that they have no idea of violating our laws, but that they propose to send vessels to the Straits of Belle Isle to seek herring cargoes, as the mackerel fishery bids fair to be a failure, and they intend to withdraw schooners from that pur-

suit and put them into the herring business. This, though, must probably mean one of two things,—either that they are making this an excuse for the securing of these fish for bait purposes, or else that they are planning to obtain cargoes of herring by this means, and probably with the aid of our people, before our new exclusion act receives the royal assent, so that thereby they may avert the threatened destruction of their herring fishery at Bay of Islands next fall by laying in a stock of herring in the mean time. The Straits of Belle Isle is a remote section of our seaboard, and they could, unless we strongly reinforced our patrol there, obtain herring rights in our bays in disregard of our laws; because the treaty of 1888 gives them the right to take fish there in common with our own people, and we can only forbid them to hire our people to help them in fishing, to employ fishing engines forbidden by our laws, or to buy fish from our coast folk. Granted, however, that they were to resort to that coast in any numbers, as now seems likely, and to prosecute the herring fishery inside and outside of our waters, a very serious condition of things would be created for us, unless we have our new enactment assented to. The Gloucester men assert that they have notified Secretary Root of their intention to embark in this new herring venture in the Straits of Belle Isle, and presumably he is satisfied; and they consequently assume that they are under no obligation to consider us in the matter at all. But it is very clear that this may be but the thin end of the wedge inserted to create a complication far more serious than any that has yet arisen in this question, and fraught with the gravest possibilities.

An interesting venture this year has been the chartering of Nova Scotian vessels and crews by Gloucester skippers for the winter herring fishery; thereby herring could be purchased without fear of interference by the Newfoundland authorities, colonial export and light dues would be avoided, as well as the heavy item of insurance and the risk of seizure. It was expected that these advantages would more than meet the cost of the import duty at Gloucester.

Capt. Wallace Parsons of the schooner “Ingomar” says that, from the experience this year at the Bay of Islands, the taking of herring by means of seines is a thoroughly feasible and profitable method of securing a cargo:—

This was proven conclusively; but for the sake of courtesy, and in order not to make any trouble at all, the American captains gave up using them after they had tried them long enough to prove their worth.

Smelts. — The “Fishing Gazette” for Feb. 3, 1906, says: —

From Summerside, P. E. I., comes the information that large numbers of smelts are being shipped from that place to the United States markets. Owing to the continuation of mild weather, many of them arrive in a tainted condition, involving loss to the shippers. The catch is growing less every year, presumably owing to the enormous quantity of mother fish taken full of spawn at this season of the year. This theory is disputed by those interested in the slaughter, who claim that the supply is so great that the limited number caught have no perceptible effect on the quantity of spawn. They attribute the falling off to the number of gill nets that obstruct the rivers and frighten the fish out to sea. The greater quantity are taken in what are known as bag nets. Most of the catch is sent forward in small lots fresh as they are taken, about \$100 each. Occasionally a car load goes, about ten tons, which should net the shipper \$1,000 if they arrive in good order and are of the best quality. A searching inquiry should be made as to the probability of exhausting this profitable industry and source of employment to a large class of laborers at a season of the year when there is little else doing.

Squid. — This important bait mollusk has been unusually scarce during the past two years, appearing only in small schools. In comparison with former conditions, the catch is more fully utilized. In present periods of abundance many thousands of crates of squid are frozen to be used for bait purposes during times of scarcity. A considerable demand also is developing for squid as food. Among fisher folk and others the squid and octopus (or “devil fish”) are still regarded as true fishes. The demand for these mollusks as food will develop rapidly, when the popular mind more generally grasps the fact that these animals are much more closely related to the clams, oysters and scallops than to the fishes, and that in personal appearance they are at least quite as presentable as the “opened oyster” of the city markets; while as a gastronomic tidbit, cut into small cubes, fried in olive oil and served with lemon juice, they are as delicious as fried scallops, which they somewhat resemble in taste.

Whaling. — It is reported that the New Bedford fleet has this year been reduced by 735 tons by the withdrawal of vessels from the fleet.

For the first time in a century not a single American whaler is at present in Hudson Bay. The methods of whaling have completely changed. The profits in the business depend upon the utilization of the carcass after the removal of the blubber and baleen. This can best be done at factories located ashore at points most frequented by whales. On the coasts of Scotland, Norway, Newfoundland and Japan successively the business has been much exploited; but a few years of activity reduces the number of whales in the region profitably accessible for the factories, and lean years ensue for the stockholders.

The "Fishing Gazette," Vol. XXIII., No. 42, says:—

Whale fishing along the coast of South America is a new industry, which is being slowly built up, according to steamship reports. They state that the whales come to the South American coast near the reefs of Abrolhos and Mere Caravellos (about 18 and 19 south latitude) to feed on the animalculæ which abound in these waters. The whales are described as being of the cachelot or spermaceti variety, which are considered the best for whaling. They state that the fishermen are natives, who go out in boats, using the old-time harpoons, and kill the whale in the manner which was in vogue more than a hundred years ago. After killing, the whales are towed to Itparico Island, where they are cut in strips, the blubber boiled, the bone removed, and in many cases the carcass, or parts of it, eaten. The whales are reported to be becoming more plentiful in the South Seas, and many whalers are sighted by ships coming here from Cape Horn. Formerly practically all the whaling was done in northern waters; but the fact that the big animals are becoming scarce in Arctic waters has driven the fleet of whalers to the South Seas, where more of the big fish are found than formerly.

Shore Fisheries.—As our coast develops as a summer resort, the fishermen find more remunerative and satisfactory occupation as boatmen for sailing and fishing parties, fishing for sport rather than for market. When such conditions arise, there quickly follows a local demand for the restriction in certain sections of the shore of all methods of fishing other than hand lines. In such cases it is necessary to consider very carefully the respective rights of all the various interests involved. While in general it is not always wise to legislate sharply in such a manner as to limit the market demand rather than to increase the supply, we believe that the principle of prohibit-

ing seining on the breeding grounds of valuable fish is appropriate and necessary. This in effect makes a reservation for fish similar in purpose to that for game mammals, birds, trees, wild flowers, etc. In a similar way, local option should be permitted to throw considerable weight in the decision. On the other hand, we must avoid the economic loss through neglect to take the annual and proper tribute of wealth from the ocean, in the form of food fish or bait. Our bait resources and necessities especially should be most carefully considered.

The "Fishing Gazette" of Feb. 3, 1906, says:—

Reports from Provincetown advise that the fleet of dory and sloop trawlers have conducted a lucrative fishery the past fortnight. On Sunday last 10 carloads of fish were shipped from the port to various points. Over 200,000 pounds of fish went out by that day's freight; 17,000 pounds of the lot, however, were from the schooner "Georgiana." Only a small portion of the immense local trawl dory fleet fished that day. For the fortnight ending Saturday last the men of the sloop "Golden Eagle" shared \$70 each; and the men of the sloop "Crescent" shared \$62 per man during the same period, \$40 being each man's share for the last seven days.

Inspection of Fish.—During this year there have been no requests for the inspection of fish, under chapter 138, Acts of 1902, and no fees have been received.

Seaweed.—The "Fishing Gazette" of June 23, 1906, says:—

Attention has recently been drawn to the profits derived from the burning of seaweed or kelp on the coasts of various countries. One of the most prolific fields for the growth of seaweed is at Joderen, on the southwest coast of Norway, where it appears as veritable forests of trees from five to six feet in height, with stems as thick as ropes and as tough as leather. The weed sprouts in summer, and gradually covers the ocean bed with a dense brush. In the fall the roots release their suction-like grip on the rock bottom, and great quantities float ashore, forming a sea wall many miles long on the beach. The fall crop is good only for fertilizer, and is used as such by the natives; but in spring what drifts in is successfully gathered, dried and burned, and during this season thousands of the farmers who own strips of the coast line make thousands of bonfires, some burning as much as 3,000 kilos a year. This is one of the natural resources of Norway, about which little was known twenty years ago. During the summer many

train loads are sent to Stavenger, whence two or three cargoes a week are shipped to Great Britain. Subsequent use and treatment are to some extent scientific secrets, although the kelp ash is known to be largely used in the making of iodine. The fact that the industry is profitable is shown by the willingness of the English agents to pay a good price; and many of the Norwegian farmers have become rich by selling it. Modern machinery, in the shape of mowers, hay rakes and harrows, have replaced the primitive farm implements in use a few years ago.

In order to keep their Glasgow, Scot., plant fully occupied, the British Chemical Company of Clydebank are encouraging the revival of the kelp industry in the outer Hebrides. Encouraged by the success which has attended their efforts in Tiree, North and South Uist, Benbecula and Barre during the past three years, the company has extended its operations to Lewis and Harris. Nearly £3,000 were distributed in the Island of Tiree alone last season, and considerably more to kelp makers in the other islands mentioned.

The amount of exertion involved in gathering and burning the tangles is light, and the average family can earn £1 per day. If a sufficient quantity can be obtained from the Hebrides, the company will not continue to get an additional supply from Norway and Ireland. A recent Nova Scotian exchange suggests that some of the inhabitants along the coasts of that province might make money from seaweed by shipping it to furniture factories all over Canada.

An interesting attempt to exploit the wealth of seaweed in this country is being made at Seattle, Wash., under the name of "seatron." This new food is obtained from kelp, the long, slimy sea plant which rises from the depths, and renders navigation along those shores at times very difficult. A man falling overboard into a "forest" of kelp would meet with almost certain death. Well, these men of Seattle have produced from kelp, by a process unknown except to themselves, a preparation which may be made into many kinds of confections, jams, preserves, marmalades, sweet and sour pickles and citron, and known as "seatron." Orders have been received from all of the places to which samples were sent for inspection, including New York City, Chicago, Minneapolis, St. Louis, Omaha and Seattle. Until the company occupies larger quarters, no attempt will be made to manufacture anything except "seatron."

This country imports a very considerable quantity of manufactured seaweed products from Japan, which might equally well be produced here.

At Chatham one firm gathers considerable quantities of eel grass, which, when dried and quilted between papers, is used in buildings for deadening walls, excluding heat and cold, etc. Its advantages consist in resistance to fire, unattractiveness to rats, mice and other vermin.

Mollusk Fisheries. — In this connection it is entirely unnecessary to call further attention to the obvious rapid depletion of the shellfish supply within this State. The waters south of Boston have yielded to the results of increased demand and unsystematic digging, to such an extent that the clam in many regions is already commercially extinct, and the quahaug and scallop are rapidly approaching the same condition. The natural supply of oysters has long since disappeared, and the entire yield is now derived from artificial cultivation. On the north shore in Massachusetts there still remains a commercial clam fishery, but by no means sufficient to supply the demand even within the State; and much of our supply is derived from Maine, Nova Scotia or Long Island. Yet, if proper and adequate measures are promptly taken to restore to the flats, estuaries and bays of Massachusetts their normal productive capacity, clam, quahaug and scallop fisheries could be developed, in these days of rapid transit and marketing facilities, which would furnish steady employment for thousands of men and women, resulting in a product valued at a minimum of \$3,000,000 annually, with possibilities of almost indefinite expansion.

The parallelism between the shellfisheries and agricultural conditions, both historical and biological, is very close. In each the original inhabitants depended entirely upon the natural products, and public ownership of land and all natural utilities was universal. Later there developed the advantage, and even necessity, of private ownership of land and its products, if prosperity in its widest sense, or even the actual subsistence of the increasing population, was to be maintained. The acquisition of titles to land areas was the first logical step. The fixing of permanent bounds was simple. The land then furnished a more readily accessible and certain source of food, which not only could be produced with relatively little labor and capital, but which from its very nature could be readily

and compactly stored in barns, cellars and granaries, where its quality did not deteriorate, and where it was quickly available in stress and storm. The chance which brought the first settlers to Plymouth rather than to another section of our coast was responsible for the present law, that the owners of land bordering tide water own the tidal flats for a distance of 100 rods (approximately the conditions at Plymouth), or to mean low-water mark if less than 100 rods from the high-water mark. In accordance with the early English law, the "fisheries," which the courts have since decided included the mollusk fisheries, were declared to be forever the property of the whole people, *i.e.*, the State; and these fisheries were for a long period open to any inhabitant of the State who might need to dig the shellfish for food for his family or for bait. From time to time, however, special grants have been made to certain towns, carrying control of the shellfisheries; special acts of the General Court of Massachusetts delegating to certain towns practically all the rights of the State in the shellfisheries within the limits of that town.

The present laws have essentially in a marked degree converted the shellfisheries, the undivided property of all the inhabitants of the State, into private holdings of the shore towns and cities. In many instances there has resulted up to the present time merely legalized plundering of the flats, local jealousies prohibiting the digging of clams, etc., by "outsiders," and little or no care given to maintaining the normal yield of the flats. The regulations made by the selectmen or the mayor and aldermen are usually but distinct attempts at checking the demand, *i.e.*, prohibiting of digging for certain periods, limit upon the number to be legally dug by any one person, etc. It would be quite as logical for a town or city to prohibit by by-laws the use or digging of potatoes or any other food crop, when the supply was short, rather than to attempt to *increase* the supply. As a result, the unsystematic methods of marketing have led to the premature destruction of far more clams than ever go to market; a similar condition would exist if the farmer should dig over his growing potato field before the crop matured, either in the hope of finding a few marketable tubers,

or to prevent the possibility of his neighbor digging up the potatoes at that time or later.

Further, the increasing demand leads not alone to the marketing of the breeding clams, and thus to a curtailment of the number of eggs laid annually, but also of the small clams, which would yield far greater profits to the diggers if allowed to increase to an optimum market size. As a result of all this, the clam has disappeared over very extensive areas, and the ground once occupied by clams has been preempted by profitless worms and worm-like animals to such a degree that the young clams apparently can no longer secure lodgment. The worm tribes catch sediment, and the flat is rapidly built up, and is likely to remain for decades of little or no economic value, perhaps becoming a constantly increasing impediment to navigation. Over other extensive areas the slimy ooze of impalpable silt and sewage have made this a graveyard for the millions upon millions of microscopic spat of the clam, quahaug, oyster and scallop, so that the area over which these animals formerly "set" is becoming restricted, with a corresponding decline in these fisheries.

The closing of areas in certain towns has in some cases driven an unusual number of fishermen to other flats, thus still further increasing the abnormal demand, with the expected result.

There are at least four distinct classes within our Commonwealth, each of which either derive direct benefits from the mollusk fisheries of our coast, or are indirectly benefited by the products of the flats:—

(1) The general public,—the consumers, who ultimately pay the cost, who may either buy the joint product of the labor and capital invested in taking and distributing the shellfish from either natural or artificial beds, or who may dig shellfish for food or bait purposes for their own or family use.

(2) The capitalist, who seeks a productive investment for money or brains, or both. Under present laws, such are practically restricted to *distribution* of shellfish, except in the case of the oyster, where capital may be employed for *production* as well,—an obvious advantage both to capital and to the public.

(3) The fishermen, who, either as a permanent or temporary vocation, market the natural yield of the waters; or, as in the case of the shellfisheries, may with a little capital increase the natural yield and availability by cultivating an area of the tidal flats after the manner of a garden.

(4) The owners of the land adjacent to the flats, who are under the present laws often subjected to loss or annoyance, or even positive discomfort, by inability to safeguard their proper rights to a certain degree of freedom from intruders and from damage to bathing or boating facilities, which constitute a definite portion of the value of shore property.

All of these classes would be directly benefited by just laws, which would encourage and safeguard all well-advised projects for artificial cultivation of the tidal flats, and would deal justly and intelligently with the various coincident and conflicting rights of the fishermen, owners of shore property, bathers and other seekers of pleasure, recreation or profit, boatmen, and all others who hold public and private rights and concessions.

That any one class should claim exclusive "natural valid rights," over any other class, to the shellfish products of the shores, which the law states expressly are the property of "the people," is as absurd as to claim that any class had exclusive natural rights to wild strawberries, raspberries, cranberries or other wild fruits, and that therefore the land upon which these grew could not be used for the purpose of increasing the yield of these fruits. This becomes the more absurd from the fact that the wild fruits pass to the owner of the title of the land, while the shellfish are specifically exempted, and remain the property of the public.

The class most benefited by improved laws would be the fishermen, who would profit by better wages through the increased quantity of shellfish they could dig per hour, by a better market and by better prices, for the reason that the control of the output would secure regularity of supply. Moreover, when the market was unfavorable the shellfish could be kept in the beds with a reasonable certainty of finding them there when wanted, and with the added advantage of an increased volume by growth during the interval, together with the avoidance of cold-storage charges. Thus the diggers could be certain of securing a supply

at almost any stage of the tide and in all but the most inclement weather, through a knowledge of "where to dig;" moreover, there would be a complete elimination of the reasoning which is now so prolific of ill feelings and so wasteful of the shellfish, viz., the incentive of "getting there ahead of the other fellow."

Excellent shellfish cultivation can be begun with little or no capital beyond capacity for accurate observation, sound common sense, intelligent patience and energy. Yet corporations or persons with large financial resources can rapidly develop safe and remunerative enterprises based upon the artificial propagation of clams and quahaugs, as has been done with the oyster, notably in Connecticut and Rhode Island, Virginia, Louisiana, and which has just been started in Maryland. Massachusetts has advantages equal to the advantages of any of these States, but has thus far made little use of them.

There are certain obvious advantages in shellfish cultivation; *e.g.*, the soil is not exhausted, as is the case in ordinary farming, and therefore no fertilizer is required. The unpublished results of some experiments made at Point Judith Pond, R. I., by the writer, indicate that a slightly increased quantity of nitrates and of potash in solution in the water may cause an increased growth of microscopic plants upon which the shellfish feed, and thereby cause a more rapid growth of the shellfish. The ordinary shellfish bed is an excellent illustration of the many remarkable natural adaptations to conditions which demonstrate the consummate economy of nature's work; and a knowledge of the biologic conditions involved indicates how man may best secure results by assisting nature. Previous to the settling of the country, the dead and decaying animal and vegetable matter, sometimes as such, but more often through decomposition on land changed into soluble nitrates, were washed from the land into the streams and thence to the estuaries and bays. In this warm and shallow water this material became quickly available as plant food. Thus the growth of algæ, both large and small, was enormously accelerated. The larger forms serve as pasture for marine creatures of various sorts; and the smaller, even the microscopic forms, deriving some portion of their nourishment from the decay of the larger, serve as a rich food for myriad schools of young fish which resort there for that

purpose, and for the shellfish, which thus increase wonderfully in numbers and in rapidity of growth. With the coming of civilization, the cutting of the forest and the agricultural operations, wash of nitrogenous material from the land is enormously increased; but if man makes no effort to increase the fish and shellfish this nitrogenous material is inevitably wasted, and an excellent opportunity to increase the wealth of the State is lost.

Because of a rapidly increasing population, there is made the economic and biologic error of turning sewage and other wastes into the streams and tidal waters in such quantities and under such conditions that this material is not speedily altered into soluble plant food. The rivers become no longer habitable for fish, and the estuaries and tidal flats are soon transformed into a stinking desert, a menace to the public health and a discreditable mark of civic indifference. Shellfish literally subsist upon the crumbs which fall from the rich man's table; but it is not well for the crumbs to reach the shellfish with undue and unnatural immediateness, *e.g.*, through the agency of sewage or garbage dumping.

In view of these conditions, it is the duty of the citizens to demand laws which shall effect a proper economic balance between the money "saved" (?) by individuals, corporations and municipalities, which dump sewage, garbage, manufacturing wastes, etc., into the public waters of our streams and harbors, and the (1) damage resulting to the public by the loss of material, which, upon biologic grounds, should be again returned to the land for irrigating and fertilizing purposes, together with (2) the destruction of millions of pounds of fish annually, and (3) of thousands of acres of tidal flats formerly producing many thousands of dollars' worth of shellfish annually. If these conditions can be ameliorated gradually, enormous benefits will ensue.

At present, however, there are in the State thousands of acres which are now relatively unproductive, for no other cause than unsystematic digging. To these flats should be applied variously modified schemes for artificially increasing the production of shellfish, through —

(1) Systematic handling of the young animals, such as thinning out and replanting them in cases where the "set" is excessive, as well as preparing suitable ground or special devices for catching the spat in economic quantities, would avert in a degree the enormous natural "infant mortality," thereby taking advantage of the natural phenomena for increasing the yield per acre.

(2) By such a degree of protection to the breeders as shall permit the production of the greatest number of eggs, yet not to cause a loss of income by retaining animals until senile decline ensues.

(3) Observations upon the size and age which yield the best profit. The scientific farmer has learned from observation that he can obtain a certain weight of meat at the least relative cost per pound by keeping a chicken, pig or steer until it reaches a certain age. By marketing the animal as nearly as possible at that age, when the cost of food for each pound of meat gained begins to increase unduly, he secures his greatest profit. In a similar way it is possible to determine at what size and age it is most profitable to the fisherman to market the clam and quahaug. (The complete results of our investigation of this question will be published later.)

(4) Much improvement of physical conditions of the soil can be economically made.

(5) Destructive enemies may be controlled through co-operative efforts, applied at the time which scientific knowledge of the life history and habits of the animal indicates as most likely to prove most effective and least expensive.

What oyster planting under suitable laws has done for many communities in Rhode Island, Connecticut and Virginia, cultivation of clams, quahaugs, scallops and oysters will do in Massachusetts. Clams and quahaugs can be cultivated at less expense and with more certainty of remunerative results than oysters. What the oyster is to Maryland, Virginia and North Carolina, the clam is to Massachusetts and to Maine. The conditions in Maryland and Virginia are well indicated by the following editorial from the Baltimore "Sun" of February, 1906:—

If oyster planting were some new thing, which had never been tried before, one could understand the fear of it by thoughtless and uninformed people. A recent writer told how the people along the first telegraph line between Baltimore and Washington became alarmed, and protested against it as a dangerous device. History tells us of the protest made by English farmers against the building of railroads, as dangerous to poultry and cattle. It has been the common experience that every great advance has been opposed by prejudice and ignorance. But it is impossible to understand the bitter and determined opposition to oyster culture by a number of people on the eastern shore and southern Maryland who will be the chief beneficiaries from it. It is no new thing; it requires no arguments to prove the advantages of it. All they have to do is to open their eyes and see for themselves what is going on all around them. Chincoteague Island is a small body of land lying on the ocean side of Accomac County, Virginia, and separated from the mainland by a broad but shallow bay. The soil is poor, and the people are mainly engaged in the oyster industry. Before oyster planting was begun, the population of the island was something like 80 or 100 families of poor, neglected people, and the whole island and all it contained was valued at \$50,000. The oyster-planting industry began, and in consequence of that industry the population has increased sevenfold, and the property valuation of the island is more than \$1,000,000. From a wild settlement the oyster industry has made Chincoteague Island a highly civilized community. There are good schools, attended by 500 pupils; free delivery of the mails; water works; a bank and many handsome residences,—giving evidences of great prosperity. Oyster planting in Maryland, it is argued by the eastern shore politician and tonger, will take the bread out of the mouths of the poor people. But, strangely enough, it puts bread in the mouths of poor people just across the Maryland and Virginia boundary; for in Chincoteague the entire population is prosperous and contented, with good earnings and excellent homes. There is no complaint about the planting system, and if any one on the island should propose its abolition, and the return to dependence on the natural beds, he would be laughed to scorn.

When Chincoteague Island depended upon natural beds, the people were poverty-stricken and led a precarious existence. Now from the small and poor island during the last thirty days 2,000 barrels of oysters have been shipped every day, and that quantity will be shipped every day for the next thirty days. One hundred and twenty thousand barrels of oysters in sixty days, worth \$200,000, from bottoms which had produced nothing! Ah! but we cannot have this in Maryland,—the politician and the tonger forbid it. It is as if the State of Maryland owned gold mines more valuable than those discovered in California in 1849, and the people around them refused to take the gold out, and forbade all others to enter them. Such fatuity passes all under-

standing. We can understand how the small-bore politician can oppose public prosperity in order that he may be elected by the votes of the tongers to the State Senate or House of Delegates or sheriff; we can understand how unlearned oystermen can be fooled by the politician; we can understand how a short-sighted man who keeps a store on the bank and makes money out of tongers will cater to their prejudices in order to get their cash; but how the people of the inland counties are willing to stand off and permit the tongers and the small-bore politicians to deprive them of all benefits, of all part and parcel in their richest heritage, passes all understanding.

The "Fishing Gazette" of April 14, 1906, says:—

We publish the full text of the Haman oyster bill, which has become a law, having been signed by the Governor. Maryland should be congratulated, for it is the end of a bitter fight of over fifteen years' standing against the passage of a measure permitting the planting and leasing of oyster beds. Instead of confining the industry to the production of the natural rocks, which are practically barren, it will be several years before the State receives any substantial benefit, although the addition of millions of dollars to the revenue of the State is in sight, as the result of the passage of the bill. Had it been killed (as a number of politicians wished), it would have meant extinction to the oyster industry of the State.

The following statements indicate the condition of the demand on the Atlantic coast, its effect upon the natural supply of clams, and the opinions elsewhere as to how these conditions must be met:—

The "Fishing Gazette" of Dec. 22, 1906, says:—

The shipment of clams to New York is a comparatively new industry. It is quite remunerative, and during the present season has reached large proportions, says the "Maritime Merchant." From Digby alone about 1,000 barrels per week have been shipped, and large quantities were also forwarded from St. John, Shediac, Prince Edward Island and several other points. As these clams are worth at wholesale in New York from \$6 to \$7 per thousand count, the business must bring in a considerable income to those localities engaged in it. According to a Prince Edward Island paper, in the neighborhood of \$2,000 a day for some weeks have been received at Summerside from the sale of clams. There is a phase of this question that demands the immediate attention of public men, and that is the preservation of the supply by the cultivation of the clam. With the continual shipment of large quantities the

depletion of the beds is a matter of a very short time only. Clam bait is a necessity to our handline shore fishermen; and, if the commercial trade be allowed to deplete the flats, the older fishery will sadly suffer. There is no need of this, as clams are easily propagated by artificial aid, little more science being required in raising a crop of clams than is demanded of the farmer who raises a crop of potatoes. The cultivation of clams is peculiarly the work of the government, inasmuch as the product is the property of the public. The matter should be taken up now, and not delayed until the industry begins to die out and prove unremunerative. The status of private ownership also requires to be more clearly defined, as some doubtless would engage in private culture were they certain the reward of their labors would not be reaped by their neighbors rather than by themselves.

The "Fishing Gazette" of Dec. 29, 1906, says:—

The clam question is getting to be a serious one in this section of Maine, says a despatch from Saco of the 24th instant. The clam flats are fast becoming depleted, and, unless some steps are taken to seed down the beds, the shellfish will soon become a luxury, if not extinct. With miles of clam flats along this coast, some of the local fishmongers are unable to get enough bivalves to supply their customers in this vicinity, and are obliged to send to the eastern part of the State each week for enough to make up the deficit. A few years ago, the diggers who live at the mouth of the river shipped many barrels of clams to the Boston and New York markets each week; now there have been days at a time the present season when they did not get enough to supply a few customers in Saco and Biddeford. One of the reasons given for the scarcity is, that in the past thousands of bushels have been dug every winter to keep the clam factories running; and another is, that during the summer hundreds of bushels are dug by the people who occupy cottages along the coast. The steady drain on the flats has exhausted the supply, the clams not being given time to grow. William O. Freeman, who has kept a fish market here for years, succeeding his father, Oliver Freeman, the pioneer fish dealer of York County, said to-day that something would have to be done, or there would be no clams in the flats along the western Maine coast, where formerly the sand was alive with them. He suggests, as a remedy, to seed the flats. He explained that this had to be done in the oyster beds, and there was no reason why it should not be done on the clam flats. He does not believe there is any other solution of the problem.

The "Fishing Gazette" of March 3, 1906, says:—

The Suffolk, L. I., supervisors have enacted a law forbidding the catching of hard clams in Peconic and Gardner's bays of a less thick-

ness than three-quarters of an inch. This is to prevent the wholesale catch and shipment to other waters of the seed clams. This business was indulged in to a large extent last year. Previously the supervisors had enacted laws forbidding the catching of these clams with a rake with openings between the teeth larger than a specified size; but the baymen got around this by drawing up a rakeful of mud, in which was imbedded hundreds of little clams. The law passed makes it a misdemeanor even to possess the clams.

The following is taken from the eleventh annual report of the New York Forest, Fish and Game Commission, p. 84:—

New York State clams are unsurpassed, the "little necks" being far-famed. They are especially in demand during the summer season, when the supply of oysters is scarce. Greatly increased quantities of clams are annually demanded, causing the stock during the past season to bring phenomenal prices. The clambers during the summer of 1905 received \$2.50 per bushel for small clams, such as they had formerly sold for \$1.25; and \$5 per thousand for large clams, which within two years they had been glad to sell at \$2.50 per thousand. Little-neck clams take to cultivation, and crops may be raised by the planter with less risk than attends oyster culture.

The following is taken from "The Oysterman" of Jan. 18, 1906:—

Prof. W. C. Stubbs, in the annual report of the Louisiana Shellfish Commission for 1906, says that the law "is working well, and under it the oyster industry has developed by leaps and bounds, not only paying all expenses, but turning over yearly increased surplus to the State treasury." This achievement is the more notable inasmuch as the Louisiana Oyster Commission, in addition to supervising the leasing of barren bottoms, is charged with the duty of protecting and extending the natural reefs, and makes annual expenditures for that purpose.

Originally, Louisiana modeled its legislation upon that of Maryland, upon the assumption that, as this was a great oyster State, the laws would be adapted to the needs of the industry. In 1886 the then oyster law of Maryland was adopted bodily, except that the areas which might be taken up as private bedding grounds in one holding was limited to 3 acres, instead of 5 acres, as in Maryland. In 1892 the area was increased to 10 acres, and in 1902 to 20 acres. These laws proved as ineffectual in building up the oyster industry as they have been in Maryland; and under scientific advice the Legislature in 1902 provided for the establishment of an Oyster Commission, to take charge of the matter. In 1904 that commission made an elaborate report,

accompanied by the draft of a bill, which, with some modifications, was enacted by the Legislature the same year, and under it the oyster industry is now thriving.

The report of the Louisiana Commission gives special consideration to the fear that under a leasing system an oyster trust, or monopoly, may be developed. The report says:—

Another of the illogical restrictions of our present oyster law is the limitation to 20 acres as being the maximum amount of barren water bottom that any one person, firm or corporation may lease for the purpose of cultivation. In any other locality and in any other industry the residents of the locality and the citizens of the State would hail with gratification and delight the development of bringing into cultivation a large tract of unreclaimed and barren lands.

We have more territory available for oyster production than is now used in the whole State in any one agricultural crop, either cotton, sugar cane or rice, and yet we have less than 6,000 acres—less than .1 of 1 per cent. of the total area—under lease. Twenty years of experience has proved conclusively that on the basis of maximum units of 3, 10 or 20 acre oyster farms no development will result; and it would appear to the commission, from the studies it has made as to this limitation, that it has been repeated in the previous oyster laws for the purpose of preventing any oyster development, with the result that the State is deprived of her just revenues from her large holdings of barren oyster bottoms. It is true that the excuse has been given that such legislation was enacted for the purpose of preventing the formation of an oyster trust. Experience shows that trusts never control the raw product, and consequently we have no cotton trust producing cotton; we have no sugar trust producing sugar; we have no rice trust producing rice. Where a trust is formed, when it is formed, it is for the purpose of handling the crop produced by some one else; and no restriction on acreage will have any effect upon the handling of the product, except as it may absolutely prevent the raw material from coming into existence and being.

The practical result of this, therefore, is that the fear of an oyster trust has heretofore paralyzed any possible development of the oyster industry. The fear is unquestionably and absolutely unfounded. If we should judge by the experience of the other States, where no limitation is placed upon the acreage that may be leased, we find that in the State of Connecticut, for instance, the oyster farmer with 3 acres successfully does business along with the oyster farming company controlling over 10,000 acres; and in no State where extensive areas are subject to leases has the complaint arisen that an oyster trust has been formed.

An accompanying report from the attorney of the Louisiana Commission goes into this matter in detail.

Statistics are given from Connecticut and Rhode Island, showing that, with no restrictions upon the size of holdings, and although the available bottoms are a limited area, there are numerous tenants and small as well as large holdings. Maryland figures as a horrible ex-

ample. Statistics are given showing the decline of the annual yield of oysters, and the remark is made:—

In its time Maryland has produced more oysters than any other oyster center in the world, yet, depending on her natural reefs, and not encouraging the production of oysters on barren bottoms by private enterprise, they have been killing the goose that lays the golden eggs. A recent visit to Baltimore shows a general feeling of depression and despair in regards to the future of the Maryland oyster industry.

Influenced by these recommendations, the law passed in 1904 raised to 1,000 acres the area which might be leased in one holding. The privilege of leasing bottoms is confined to residents of Louisiana, firms composed of residents of Louisiana and Louisiana corporations, and none others may hold these leases. Non-residents acquiring such leases by inheritance or transfer have twelve months in which to dispose of them, but no longer, under penalty of forfeiture. Shipping oysters for canning or packing outside of the State is prohibited, and no oysters in the shell can be shipped out of the State without a permit from the commission. The intention of the law is that, so far as possible, the shells can be used for planting upon barren bottoms. The commission is authorized to expend \$5,000 a year "in improving and enlarging the natural oyster reefs, by depositing and spreading shells, breaking up bunched oysters, and by the use of such other means as the commission shall determine."

Leases are for the term of fifteen years, at the rate of \$1 an acre, renewable for ten years longer, at the rate of \$2 an acre. The lessees may work their grounds in any way they please, and take oysters from them at any time they please; but oysters cannot be taken from the natural reefs between May 1 and September 1, except as seed to be used upon leased bedding grounds, and then only by special permit by the Oyster Commission. The act, which is a long one, is stringent in its requirements. Vessels in which violations of the law have been committed are liable to forfeiture; and individual persons found guilty may be fined from \$50 to \$1,000, or be imprisoned from thirty days to two years, or both. As the law went into operation only last year, no official report of results is as yet obtainable; but Professor Stubbs states that the number of acres already leased and under cultivation amount to over 50,000. The oyster yield is rapidly increasing, and the future of the industry is regarded as assured. The law provided that the surplus shall go one-half to the public school fund and one-half to road improvement.

Pollution of Harbors and Estuaries, and the Effects upon the Public Health through the Shellfisheries. — The ill effects of unscientific disposal of sewage and of factory wastes are

becoming increasingly evident. (1) Not alone are the streams and rivers made impossible to salmon, trout, shad, herring and other food and game fish, but also (2) in many instances the vile flood completely kills the microscopic plants which are the natural agents for purifying the water, and which by their growth furnish food for the schools of young fish, either in the fresh water or in the estuaries and bays where these rivers enter the sea. Further, this polluting material in certain instances is of such a nature and in such a quantity that it not alone destroys these microscopic plants, thereby driving from their nursery the millions of young fish which formerly resorted here for food, but (3) also drives away the larger fish, which depend upon the smaller fish for food. In addition to this, (4) the slimy, precipitated sludge kills the young of the edible shellfish. This sludge oxidizes and nitrifies slowly in salt or brackish water, and persists for so long a period that (5) the accumulated slimy ooze rapidly changes the nature of the bottom, so that it becomes no longer favorable for the growth of shellfish. (6) Moreover, the sewage sludge is a positive menace to the health of the community which uses the shellfish. This danger is due to the fact that oysters, clams, quahaugs ("little necks") and mussels act as living filters, removing from the water not alone the microscopic plants which are their normal food, but also gathering in from the sewage the disease-producing bacteria (of which perhaps the typhoid germ is most to be feared). These remain entangled in the gills or within the stomach and intestine of the shellfish. If the shellfish is eaten raw or only imperfectly cooked, the bacteria are likely to again be the direct cause of typhoid fever. All these facts have been convincingly shown in the journals of sanitary research by competent investigators in this and other countries. Investigations upon the conditions on the shores of Massachusetts have been published in the report of the State Board of Health for 1905.

In addition to the positive danger arising from eating shellfish from polluted shores, there is a more remote danger of bringing living typhoid and other harmful bacteria upon the hands, baskets and implements from the mud and polluted water of these areas, and thus infecting directly or indirectly the drinking water or the food materials either in the market or the home.

We cannot therefore commend too strongly the action of the State Board of Health in investigating as promptly as possible the sanitary condition of the shellfish in the waters and flats so obviously polluted, and in wisely using the power properly intrusted to that Board by the Legislature by prohibiting the taking of shellfish from certain definite regions which are found to be polluted to a degree which endangers the public health. The waters and flats of New Bedford and of Boston harbors have already been proscribed. Unless active means are taken in the immediate future to improve the polluted conditions of the Merrimac River, and to purify the sewage which enters the river itself and also the estuary, one of the most valuable shellfisheries of the State, the Joppa flats, is in grave danger.

Action was taken upon New Bedford harbor in August, 1904. On Jan. 1, 1907, a similar prohibition upon the taking of clams, oysters and quahaugs in Boston harbor went into effect.

The following is a copy of the public notice given in the daily and weekly newspapers: —

The State Board of Health, acting according to section 113 of chapter 91 of the Revised Laws, on Dec. 6, 1906, requested the Commissioners on Fisheries and Game to prohibit the taking of any oysters, clams or quahaugs from the waters or flats of Boston harbor, including the tributaries of the Charles, Mystic and Neponset rivers and Chelsea River and Dorchester and Quincy bays, inside or west of a line drawn from Nut Island to Prince's Head; thence along the bar from Prince's Head to Peddocks Island and through Peddocks Island to the northeasterly end thereof; thence to the southeasterly point of Deer Island and through Deer Island and across Shirley Gut to Point Shirley, excepting along the Winthrop shore inside or northeast of a line drawn from the outer end of the steamboat landing of the Point Shirley Club at Point Shirley to the outer end of the Cottage Park Yacht Club wharf on the southerly shore of Winthrop, between Orlando and Woodside avenues; also about the shores of Lovells, Gallups and Georges islands.

All persons are hereby notified that the taking of clams, quahaugs and oysters within the above-described boundaries is prohibited on and after Jan. 1, 1907, and that all persons violating this order are subject to a fine of not less than \$5 or more than \$100 for each offence.

GEORGE W. FIELD,
E. A. BRACKETT,
J. W. DELANO,

Commissioners on Fisheries and Game.

The baleful effects of pollution upon the river fisheries (notably the shad) and the shellfisheries have become so obvious that this year the mayor of New York approved a bill requiring the appointment of a special commission of five experts, to report on an effective method of protecting the waters of New York bay from pollution. This measure has been urged for several years by the Chamber of Commerce, the Maritime Association and the Board of Trade and Transportation. This bill directs the secretary of New York State to communicate with the Governor of New Jersey, inviting him to co-operate with the new commission.

During this year the biologist of the commission, D. L. Belding, A.B., under our general direction, has continued the biological study of the shellfish. Some of the results are given in his report, together with that of J. R. Stevenson, A.B., assistant biologist, both of which follow:—

REPORT ON THE SHELLFISHERIES OF MASSACHUSETTS.

DR. GEORGE W. FIELD, *Chairman, Massachusetts Commission on Fisheries and Game, Boston, Mass.*

DEAR SIR:—I beg herewith to submit the following report of the investigations conducted by the commission upon the shellfisheries of Massachusetts.

According as the appropriations permitted, a three years' plan of work, ending next year, has been outlined. At the end of this time a report containing all the results of the three years' investigations upon the economic shellfish will be issued, as it is impossible, owing to the work mapped out, to give any complete report before all experimental results are obtained. The following is a brief summary and outline of the shellfish work of the past year, for the purpose of indicating its general trend, and is therefore by no means to be considered as a complete report.

The work of the past year has been confined chiefly to the investigation of the life and habits of the clam, scallop, quahaug and oyster.

Work has been conducted chiefly at the commission's laboratory at the Powder Hole, Monomoy Point, at Plymouth and at Ipswich. At the same time, the work of planting experimental beds and of the biological survey of the areas capable of producing shellfish has been under way along the whole coast.

During the summer four assistants were provided by the commission. Two of these were stationed on the north shore and two at Monomoy Point. The work on the north shore was in charge of Mr. Stevenson,

whose report on certain phases of the clam problem follows. He was ably assisted during part of the summer by C. B. Coulter of Williams College, and later in the fall by F. C. Lane of Boston University. At Monomoy Point the assistants were W. H. Gates of Williams College and C. L. Savery of Marion.

I wish to express my sincere thanks to my assistants, without whose help and intelligent work the results of the past year could never have been obtained.

I also wish to express my appreciation of the many favors and helpful suggestions given by Capt. George W. Bloomer and Capt. James P. Smith, as well as of the courteous treatment extended by the surfmen and fishermen at Monomoy Point.

It was found absolutely necessary to have at least a temporary laboratory. Such was equipped at Monomoy Point, which offered the best situation then known for work upon all four shellfish. The body of water, here known as the Powder Hole, furnishes a variety of conditions favorable for unmolested experimental work.

The laboratory consists of a two-room cottage, one room 10 by 12 feet, the laboratory proper, the other 10 by 11 feet, the living room. The laboratory was fitted with work bench, aquaria, sink, shelves, etc. While not elaborate, it answered its purpose, providing accommodation and working facilities for three men.

In connection with the shore laboratory, a raft 10 by 20 feet, with trap wells, was of great use. A large number of exact shellfish experiments were conducted from this, especially along the line of spat collecting and rearing of the young larvæ. Besides the work at these two stations on the north and south shores, a third line of work, which might be called "work along shore," has been started. This includes the completion of a survey of the clam and shellfish area of the State, and the further study of the numerous clam, scallop and quahaug beds which have been put out at various places along the entire coast.

Long-necked or Soft-shelled Clam (Mya arenaria).—The tide flats of the entire coast of Massachusetts in former years were exceptionally productive of the soft-shelled or long-necked clams. To-day Massachusetts still possesses these same flats, but the clams have disappeared; yet not entirely gone, though only a remnant of a former abundant supply remains. Only in the northern part of the State is there any suggestion of the former abundance. The clam flats of Essex, Ipswich and Newburyport furnish the bulk of clams dug within this State for the market; yet even at these places, with their enormous flats, the present yield can not compare with that of the past. At Essex, for example, the flats which once offered employment to 100 clambers now barely furnish enough for 15. Slowly but surely this valuable industry is passing away. A comparison of the yields of various years shows that since 1888 the clam production of this State has been steadily on the decrease.

The cause of this decrease has primarily been *over-digging*, as the clam area is definitely restricted, and the clam, fast in the soil, cannot escape like a migratory fish; thus total areas have been swept clean. An increasing demand, especially in summer, has worked havoc.

However, the outlook for the future is not so hopeless as it may seem, if proper measures are used. It is not the demand that must be checked by closed season or other means, but the supply must be increased to meet the increasing demand; in other words, nature must be assisted. There are hundreds of acres of flats to-day practically barren, which can be made productive at a comparatively slight expense if put under proper cultural methods.

Methods of Work.—Cape Cod marks the division between the flora and fauna of northern and southern New England. For this reason, owing to the diversity of conditions of clam life north and south of Cape Cod, it was found necessary to run parallel experiments. Work on the south shore was conducted at the commission's laboratory at Monomoy Point, in connection with the scallop and quahaug work. Work on the north shore was conducted chiefly at Ipswich and Plymouth, under J. R. Stevenson, assistant biologist of the commission, with the help of C. B. Coulter of Williams College during the summer months.

Mr. Stevenson in his report, which follows, has considered with much success such important points as: (1) spawning season on the north shore; (2) study of clam set in the various harbors of the coast, to ascertain the physical conditions influencing the same, rapidity of growth and relative abundance; (3) summer growth on north shore; (4) methods of clam culture; (5) practical methods of reclaiming flats now unproductive; (6) survey of present clam area on north shore.

At Monomoy Point work on the clam consisted chiefly of: (1) comparative growth experiments; (2) study of embryology and early life history; (3) artificial methods of raising larvæ; (4) spat collecting; (5) enemies; (6) survey of clam area on south shore.

Growth Experiments.—Growth experiments have been conducted at available points along the entire Massachusetts coast. Between 200 and 300 artificial beds of various sizes have been laid out during the summers of 1905 and 1906. These beds are situated at Dartmouth, Marion, Monument Beach, Onset, Woods Hole, Edgartown, Nantucket, Harwichport, Chatham, Monomoy Point, Provincetown, Plymouth, Lynn, Annisquam, Essex River, Ipswich River, Plum Island, Newburyport.

Each bed is set out to illustrate a particular point in regard to conditions, favorable or unfavorable, which influence the growth of the clam, and for this reason are situated in every conceivable location. A record of each bed is kept on file, giving all facts about its natural location, records of clam growth, etc. By a comparison of these beds the favorable and unfavorable conditions for clam culture may be

ascertained. The majority of the beds are in *unfavorable* locations. The idea is, not to plant a large number of beds where we know clams will grow well, but to find out why they do not do as well in other places, where there are few clams. Therefore beds are put in these poor places, as often through the failure of a bed the cause is discovered and a remedy suggested.

Mr. Stevenson in his report will outline the methods used on the north shore.

The methods followed at Monomoy consisted in monthly records of the growth of a large number of clams, comparing the various conditions. General work of the past year upon the habits and enemies was continued. A study of the early life history of the clam along the same lines as that used with the scallop was followed. Records of the spawning season were made by daily count of the relative number of larvæ in the water, using a plankton net of silk bolting cloth.

A succinct statement may perhaps best be made by briefly answering certain questions which have been placed before us for solution. The evidence upon which these answers are based must in general be reserved for the complete report.

Soft-shelled Clam (Mya arenaria).

I. Distribution. What is the extent?

The soft-shelled clam is found on the Atlantic coast, principally north of New Jersey. It is found in varying quantities on all the tidal flats of Massachusetts, especially abounding in estuaries.

II. What places in Massachusetts produce the bulk of marketed clams?

Essex, Ipswich and Newburyport.

III. What have been the causes of the alarming decrease in our clam supply in the last twenty-five years?

The chief cause has been *over-digging*, resulting in a total destruction of certain clam areas, due to the unintelligent methods of taking this shellfish. An increasing demand has established a constant drain upon the flats. Pollution of river water and other natural or artificial changes have worked toward the same end.

IV. What is the remedy?

Do not stop the demand, but increase the supply to meet it; assist nature. There are hundreds of acres now hardly producing clams that are capable of an enormous harvest if properly planted with seed clams by the town authorities. On the other hand, there are flats which from disuse cannot be made to produce clams by merely sowing the seed; other methods of preparation are necessary with these before they can be put back to their former fruitful condition.

V. What is the natural growth of the clam per year?

There is great diversity in the growth of the clam, owing to the location in respect to three essential conditions, — current, length of time

submerged, and soil. The following figures give briefly the general trend of results from numerous experimental beds under great variety of conditions. For simplicity, a 1-inch clam is taken as the standard.

A 1-inch clam will grow in one year to a size between 2 and 3 inches. Under fairly favorable conditions, with a moderate current, a 1-inch clam will increase to 2½ inches, or a gain of 900 per cent. in volume. For every quart planted, the yield in one year will be 9 quarts. For beds without current, 1-inch clams average about 2 inches, or a gain of 500 per cent.; *i.e.*, five quarts for every quart planted. Beds under exceptionally fine conditions have shown the amazing return of 15 quarts for every quart of 1-inch clams planted. Clams increased in these beds from 1 to 3 inches in length. Therefore, by planting clams 1 inch or over, under *favorable* conditions a *marketable* clam can be produced in *one year*.

VI. *What is the maximum production per square foot?*

The number of clams per square foot that can be raised to the best advantage depends upon the location of the flat in respect to natural conditions. Clams thickly planted (15 to 20 per square foot) in favorable locations may show a greater growth than when thinly planted (5 per square foot) in less favorable locations; therefore, no definite statement can be made which will apply in all cases. The only rule that can be given is that a flat with a current will produce a greater number of clams per square foot than one without a current. On good flats clams can be planted conveniently and economically from 10 to 15 per square foot, or even a larger number.

VII. *What results can be obtained by planting on barren flats?*

There are two groups of flats which come under the term barren: (1) flats which once produced clams in great numbers, but now are practically barren, except for an occasional clam here and there; (2) flats which never have produced clams, and on which for physical reasons clams can never grow. The first group of flats is alone considered in this answer.

Experimental beds were planted on certain flats in the Essex River which come within the first group of barren flats. These once productive flats had been cleaned out in the past, and for some reason had not seeded naturally. Forty beds were laid out under all kinds of conditions, with the object of finding a way to make these once more productive. Results have been all that could be hoped for. Only 4 poor beds were found, out of the 40 laid out; 36 beds were in thriving condition. It should be noted that no attempt was made to choose the best places, but all conditions were tried. Over two-thirds of the clams were re-dug, the increase averaging, in terms of 1-inch clams, over 1,000 per cent., or 10 quarts for every quart planted the year before.

If many acres of Massachusetts flats, idle at present, are capable of such a yield, should such economic waste be allowed? Why should not the towns, by the expenditure of a little money, re-stock flats such

as these for the benefit of their inhabitants? I do not say that all flats can be made productive in this way, as I know of many cases where the mere sowing of seed clams will not re-stock a flat; but I do say that Massachusetts possesses enough flats of the former nature, which should be made a profit to her clammers. Clam set occurs, as Mr. Stevenson shows in his report, in large quantities; the transportation of seed clams is easy; planting requires little labor, the practical way being to sow the clams, which burrow readily; while the yield in proportion to the labor is enormous.

VIII. *What sized clams are best for planting?*

The size best adapted must be determined for each flat. Shore flats with little current will allow the planting of any size, from $\frac{1}{4}$ inch up; flats with a swift current necessitate a larger clam (1 to $1\frac{1}{2}$ inches), as the smaller will be washed out of its burrow; soft mud also demands a larger clam, as the smaller will be stifled by the oozy silt.

IX. *What are the physical conditions that influence the growth of clams?*

There appear at least three essential conditions for rapid growth of clams: (1) a good current; (2) low and level flat; and (3) a tenacious soil, relatively free from decaying matter.

A low flat gives the clams longer feeding periods, as the water remains over them longer, therefore there is a greater growth. This has been experimentally shown by Dr. A. D. Mead.

According to Prof. J. L. Kellogg, clams cannot do well in a soil which contains much decaying organic matter, as the acids eat away the shells. Soils of this description also facilitate the spread of infection from one clam to another.

Current is the chief essential for successful clam culture. The term "current" does not imply a rapid flow of water, but rather a good circulation of water over the flat. In the Essex and Ipswich rivers the clam flats have a continuous current. On such flats the growth is more rapid than on flats which have no circulation of water, in addition to the mere rise and fall of the tide. The current performs the work of (1) keeping the flats clean and carrying away all contamination, but its most important work is as (2) *food carrier*.

X. *What is the food of the clam?*

The food of the clam consists mainly of microscopic plant forms, — *diatoms*. These are found everywhere in the water. With the clam, food is the chief essential for growth; the more food it gets, the faster it grows. Current causes more food to come in reach of the clam; therefore, clams located in a current are better fed. The fact that currents mean more food explains why circulation of water is the primary requisite for good clam growth.

XI. *When is the spawning season?*

The varied physical conditions and range of Massachusetts sea coast

makes it necessary to divide this answer in two parts: (a) south of Cape Cod; (b) north of Cape Cod.

(a) Spawning begins about the middle of June, reaching its height between July 15 and August 5; it lasts until after the middle of September, larvæ then being found in the water, but not nearly so abundant as in July.

(b) The season north of Cape Cod is much later; spawning lasts from the middle of August until the first part of October.

XII. *What are the natural enemies of the clam?*

The young clams are beset by many enemies which do not trouble the adult. The worst enemy of the young clam is the starfish, particularly the young of that species. Crabs, ducks, shrimps, small fish, etc., also prey upon the young clam.

The only active enemy of the adult is the common winkle (*Lunatia duplicata* and *L. heros*). This enemy burrows beneath the sand and drills a hole through the shell of the clam, through which it sucks the contents. Only clams between 1 and 2 inches are destroyed in any quantity, as the winkle does not burrow deep enough for the larger clams. One winkle can dispose of 2 2-inch clams in three days.

Outline of Early Life History. — (a) How the eggs are laid: With the clam the sexes are separate. Both eggs and sperm are extruded in great quantities from the female and male clam, respectively, at the time of spawning. Fate willing, fertilization takes place as the eggs float in the water; often the egg is not fertilized, and soon perishes.

(b) Embryology: As with the scallop, the egg after fertilization passes through a definite series of changes, resulting in an elongated larval creature with a long "feeler," the flagellum. This little animal swims with a spirally rotary motion by means of exceedingly delicate hairlike processes (cilia) which cover the anterior end of its body.

(c) Veliger stage: A second change, — after three days we find an entirely different-appearing animal. An embryonic shell has formed, covering the whole body. The flagellum and ciliated portion of the first embryo have changed into a smaller but more powerful swimming organ, the velum, which consists of the long feeler and a circular fringe of lashing cilia. From $\frac{1}{250}$ to $\frac{1}{300}$ of an inch in size, this little form swims in great numbers through the water, where it is the prey of various forms of sea life, even of the mother clam, which sucks down many of her hapless babies. To give a slight idea of the enormous number in the water during the spawning season, it might not be out of place to state that the usual catch with a small plankton net, 12 inches in diameter, in a single tow of 100 yards, is from 25,000 to 30,000.

(d) Footed larva: The veliger stage lasts ordinarily less than three days. It is hastened or retarded by the temperature of the water. During this period there develops the most useful organ of the clam's

later life,—the *foot*. At the same time the velum gradually disappears. The first use of the foot seems to be as a swimming organ, as numbers of early footed embryo are taken in the plankton net at the surface. The main use of the foot is crawling. The young clam, by the extension and contraction of the foot, can force its way along any surface.

(e) Byssal stage: The clam soon passes into what might be called the late crawling stage. The siphon or “snout” is plainly seen, the gills have developed, and the foot is the largest part of the body. The clam has acquired a new power,—that of attachment. From a gland on the ventral side of the foot a thread is spun, which acts as an anchor, fastening the clam to objects such as sand grains, sea lettuce, shells, etc. This thread (the byssus) is a single strand with several branches. At this time the clam measures less than $\frac{1}{50}$ of an inch. The byssus can be cast loose at will and the clam can crawl to a more suitable locality, where it rapidly spins another. Prof. J. L. Kellogg, in his first paper upon the clam, in which he made a very successful and complete study of the clam during the byssal stage, showed how great numbers of the young first attached to *Enteromorpha* or to sea lettuce floating in the water, and thence when larger migrated to the flats. Thus we have two methods of clam set: (1) where the clam attaches itself to objects in the water, and later migrates to the flats; (2) where the clam sets directly on the flat, and anchors itself to the sand grains by the byssus. The clam maintains its byssus until fully half an inch long. The foot becomes relatively smaller as the clam increases in size, and is used as a burrowing rather than a crawling organ.

Destruction of Clam Larvæ.—During the free swimming period the young clam is at the mercy of the tides and currents, with the result that it is often carried great distances. When the right conditions are present it sets in large numbers, although in most cases the clam does not strike good ground, and soon perishes, either washed out by swift currents or smothered in soft mud.

Cold rains destroy the swimming larva. An observation upon this point gives the following figures. During a long, cold rain, counts were made of the number of larvæ in a certain amount of water which passed through the plankton net: before the rain, 30,000; after nine hours, 15,000; after fifteen hours, 3,000. After the rain ceased the number of larvæ gradually increased, until it was the same as at the first count.

Scallop (Pecten irradians).

The yield of the Massachusetts scallop fishing for the year 1902 is given in the report of the United States Fisheries as 66,150 bushels, valued at \$89,982. However, the area of this industry, which is confined chiefly to the southern coast of Massachusetts, is rather limited.

The mere value of this industry alone is ample reason for the protection of its future, both in the interest of the fishermen and of the consumer.

The importance of a thorough knowledge of the life and habits of the scallop, in fact, of all the shellfish of economic value, cannot be over-rated. Complete knowledge of its methods of life, enemies, etc., is absolutely essential to any legislation for the protection of our future scallop industry, and only from such knowledge can successful cultural methods be devised.

The commission has outlined work for three years upon the scallop, and at the expiration of that period, in 1908, a complete history of its life, habits, and facts pertaining to scallop culture, will be ready for publication. The following is a brief summary of several points relating to this shellfish, which have been newly discovered or confirmed by us this past summer. For convenience, these have been put in the form of questions and answers.

Methods of Work.—As a rule, in work upon all the shellfish the same methods are used, with modifications suited to the individual species. The following is an outline of the methods pursued by the commission in its work upon the scallop.

Growth Experiments.—For the past two years such experiments have been carried on under all possible conditions, and large numbers of scallops have been under observation at various places in Massachusetts. Several different methods have been used, to check possible errors:—

1. Scallops were confined in pens, made either of wire netting or twine netting. As far as is known, this has been the first successful attempt to grow scallops in confinement. Each division contained 50 square feet; some pens contained several divisions, some only one. Scallops were separated by sizes, and each size assigned a division. In all, 7 pens, or 12 divisions, were built, at the following places: Monomoy Point, 3 pens; Chatham, 2; Monument Beach, 1; Marion, 1.

The object for locating these at various places was: (1) to compare the growth in different localities; (2) to ascertain comparative growth under different conditions; *i.e.*, bottom, current, eel grass, sand, etc.

These pens contained different numbers of scallops, the largest containing 1,000. Monthly measurements were made for each pen, and the rate of growth for that locality determined, thus permitting the determination of the best growth under many conditions. It was found necessary to make three measurements for each scallop: (1) from hinge to edge of shell; (2) at right angles to this, across shell; (3) thickness. By means of these three measurements the relative increase in volume could be calculated. The method of water displacement for increase in volume used with the quahaug could not be applied to the scallop, owing to its inability to close the shell tightly.

2. A somewhat similar method of obtaining growth of the scallop

was used by placing them in wire cages suspended from a large raft. Monthly records were taken.

3. Another method used in connection with the pen methods was the measuring of large numbers of well-sampled scallops at regular intervals at Edgartown, Nantucket, Marion, Chatham and other places. A line, called the growth line, is usually found on scallops over a year old. This growth line is caused by the scallops resuming growth about May 1, after a winter's rest. Thus, by measuring the growth line at the same time, the exact growth of the scallop from May 1 could be determined. As many as 5,000 scallops were measured at each recording.

4. Another method for obtaining knowledge of the individual growth and of the migration of scallops was devised by fastening a copper tag with a stamped number to the hinge. This did not interfere with the growth, and allowed the scallop to go unpened. At Monomoy Point 500 tagged scallops are under observation. Certain scallops were kept over winter by placing them in wire cages, supported from a framework deep enough to escape the ice.

In considering the growth of the young "seed" scallop, two methods were used: (1) a thousand small scallops, part of which were caught on spat collectors, were placed in wire cages of fine mesh; these were suspended from a raft. As the scallops increased in size they were transferred to cages of larger mesh. Monthly records were taken of their growth. (2) Numbers of scallops (500 to 1,000) were measured at monthly intervals at Marion, Chatham, Edgartown and Nantucket. Care was taken each time to get scallops from the same locality.

Spawning Season.—Five methods were employed on this problem:—

1. (a) Recording the color of the egg sac by means of a color standard. The eggs of the scallop when ready to spawn are a bright orange color. (b) By means of Prang's color standard a record was kept at intervals during the spawning season of large numbers of scallops at Marion, Nantucket, Edgartown, Monument Beach, Chatham and Monomoy Point. (c) Certain scallops confined in wire cages were under close observation during the whole season, and individual changes noted. The color gives a true test, as it disappears after spawning is completed.

2. Microscopic examination of eggs.

3. Artificial fertilization of eggs.

4. Plankton net.

5. Appearance of the young set at Nantucket, Marion, North Falmouth, Chatham, Edgartown and Monomoy Point.

The early life history of the scallop from egg to adult was followed by (1) artificial fertilization of eggs, (2) plankton net and microscope.

I. *What is the normal length of the scallop's life?*

The natural life of the scallop is from twenty-two to twenty-six

months; relatively few scallops pass the two-year limit. While this was the prevailing opinion among scallopers, no absolute proof had ever been obtained until the past summer. Exact data upon this point were obtained from scallops which had been under observation in wire pens at Monomoy Point for two years. Records of death rate from old age show that, of 500 scallops alive May 1, 22 per cent. remained by July 10, and only four per cent. August 2. In July these scallops would have been two years old. Scallops one year old, confined under similar conditions, showed only a slight mortality.

II. *At what age does the scallop spawn?*

The scallop spawns when exactly one year old.

III. *Does the scallop spawn more than once in its life?*

The majority of scallops spawn but *once* during their lives, *i.e.*, when one year old; not over 25 per cent. reach a second spawning season.

IV. *What important bearing have these first three points upon legislation for the protection of our future scallop supply?*

All scallops under one year old *must* be *protected*, as these furnish practically all the spawn for the following year. Only scallops under this age *need* protection. If the scallop under one year old is protected, the law has done all in its power to insure the future of this profitable industry. It does no harm to capture scallops *over* one year old; in fact, it would be an economic loss if they were not taken, as nearly all die before a second season.

V. *Spawning season in Massachusetts, — when does it take place, and how long does it last?*

The spawning season of the scallop begins the middle of June and ends the middle of August. The height of the season is through the month of July. During these two months the temperature of the water ranges from 62° to 72°, averaging 67½°.

VI. *Is the spawning season uniform in Massachusetts?*

The spawning season is comparatively uniform along the southern coast of Massachusetts. Observations at Nantucket, Edgartown, Chatham and in Buzzards Bay show that the limits are practically the same, although in Buzzards Bay the main part of the spawning is slightly in advance of the other places.

VII. *What was the average size of the scallops taken during the (1905-1906) season at Nantucket, Edgartown and Chatham?*

Nantucket, 2.1716 inches; Edgartown, 2.1789 inches; Chatham, 2.13 inches. At each place 10,000 well-sampled scallops were measured. The measurement is taken from the hinge of the scallop to the opposite side.

VIII. *Why is a sand-bottom or channel scallop larger than an eel-grass scallop?*

Scallopers know from experience that you can find larger and better scallops in the deep channel or on sand bottom than in the shallow water among the eel grass. These are scallops of the same age, only



From Inward Point, Chatham, Mass. (Nov. 25, 1906.) All natural size. The average size of the sets of 1905 and 1906. Very few scallops pass the two-year mark.



From Powder Hole, Monomoy Point, Chatham, Mass.; from spat box No. 15. (Nov. 19, 1906.) All natural size. These quahogs, clams and scallops, as swimming larvae, settled in a box filled with sand and suspended from a raft in the deeper part of the Powder Hole. In August, 1906, they were too tiny to be seen by the naked eye; hence they have made this growth during three months. All the conditions for this rapid growth, however, were unusually favorable.



From Powder Hole, Monomoy Point, Chatham, Mass.; from spat box No. 11, area one and one-half square feet. (Nov. 19, 1961.) All natural size. Petricola, scallop, soft-shelled clam, razor fish; grown to this size in little more than two months, from a natural set caught in a spat box.

the former has grown more rapidly than the latter. The increased growth of the channel scallop is due to its more advantageous location. The difference in growth is due to the *current*. The same is true with the clam and quahaug; those situated in the current grow most rapidly. Every shellfish needs circulation of water for growth; eel grass cuts off the current and prevents the circulation of water. The growth of the scallop depends upon the amount of food it can procure. This microscopic food is found rather evenly distributed throughout the water. *Currents* bring *more* food. As more food is brought to the scallop in the channel by the free circulation of the water, the growth there is naturally more rapid.

IX. *What is the food of the scallop?*

The greater part of the food of the scallop, clam and quahaug consists of certain microscopic plants, called *diatoms*. These tiny forms are extremely varied in size and shape. They are easily recognized by their silicious cases and beautiful markings, which have won for them the name of "the jewels of the plant world."

X. *How large does a scallop become?*

It is possible for the channel scallop to attain at times the size of $3\frac{1}{4}$ to $3\frac{1}{2}$ inches. In Buzzards Bay they are larger than at Chatham, Edgartown and Nantucket. Of the 1905-06 catch at Chatham, only 2 per cent. were over $2\frac{1}{2}$ inches; at Edgartown, 1 per cent.; and at Nantucket, $3\frac{1}{3}$ per cent.

XI. *When does the scallop begin to grow in the spring, and when does it cease growing in the winter?*

The period of growth of the scallop depends upon the temperature. The following results are for a scallop during its second summer: the scallop resumes growth in the spring, usually about May 1, when the temperature of the water has reached 50° ; it is then about nine months old.

XII. *Which are the most favorable and least favorable months for scallop growth?*

The same scallop ceases growth in the fall, usually in the latter part of November, when the temperature of the water has fallen below 50° . In the following answer each month is given a numerical value, representing the gain for that month in millimeters (25.4 mm. to the inch.) These results were obtained from monthly records taken from a large number of scallops confined in pens at Monomoy Point:—

January, -	July, 2
February, -	August, $4\frac{1}{2}$
March, -	September, $4\frac{1}{2}$
April, -	October, 3
May, 4	November, 1
June, 2	December, -

XIII. *Do scallops cease growing during the spawning season?*

From the above table it can be seen that during June and July, the spawning months, the growth is half that of May and August. This indicates a slower growth during this period, but *not* a cessation of growth.

XIV. *The growth line,—what causes it?*

In old scallops a line, known as the growth line, can usually be found running parallel to the edge of the shell. This varies greatly in prominence, as it is hardly discernible on some scallop shells. This line is formed in Massachusetts scallops about May 1, when they resume their growth after the cold winter months, during which all growth ceases. This growth line is not caused by the spawning season, as has been supposed, since our observations indicate that there is no cessation of growth during June and July, the spawning months. This distinct growth line arises long before the spawning season.

XV. *What was the average size of "seed" scallops May 1, 1906, at Nantucket, Edgartown and Chatham?*

Nantucket, 38 mm. (1.52 inches); Edgartown, 37 mm. (1.48 inches); Chatham, 42 mm. (1.68 inches).

XVI. *Growth of "seed" scallops.*

A "seed" scallop, according to a broad definition, is a scallop less than one year old.

Usually seed scallops are attached to eel grass by a thread called the byssus. As with the old scallops, the position of the seed scallop in relation to the circulation of water is of great importance for its growth. Often the majority of a set is unfavorably located, as the eel grass cuts off the current.

The young scallops vary in size, as those of the same set are, for example, on December 1 found to range from $\frac{1}{2}$ to $2\frac{1}{4}$ inches; it is therefore difficult to give correct averages. The following figures give in a general way the growth of the young scallops of 1906 at three different localities:—

LOCATION.	Average Size of Seed Scallops.
Marion,	On August 9, 11 mm., or $1\frac{1}{25}$ inch. On December 1, 34 mm., or $1\frac{19}{25}$ inches.
Chatham,	On August 1, 11 mm., or $1\frac{1}{25}$ inch. On September 1, 20 mm., or $\frac{4}{5}$ inch. On December 1, 33 mm., or $1\frac{13}{25}$ inches.
Edgartown,	On September 1, 13 mm., or $1\frac{13}{25}$ inch. On December 1, 30 mm., or $1\frac{1}{5}$ inches.

XVII. *What is the range of the scallop?*

The general northern range of the shallow-water scallop (*Pecten irradians*) is Plymouth; from this point it extends southward along

the Atlantic coast. Prof. J. L. Kellogg of Williams College, the well-known authority on lamellibranchia, in his report on oyster culture in the Gulf of Mexico remarks upon the presence of this same species of shellfish near the Chandleur Islands.

XVIII. *What were the scalloping centers of Massachusetts in 1906?*

Nantucket, Edgartown, Dennis, Hyannis, Chatham, Marion and New Bedford furnish the bulk of the Massachusetts scallop supply.

XIX. *What are the natural enemies of the scallop?*

The scallop has two important natural enemies,—the starfish and the oyster drill. The former is the more destructive. Its method of attack is the same as used upon the oyster, its favorite prey. The smaller starfish are the more destructive, especially to the small seed scallops. The oyster drill pierces a fine hole through the shell of the scallop by means of a rasping "tongue," and then sucks out the contents. The drill is not nearly so destructive to the scallop as to the oyster, since the scallop often can shake the invader off with a quick snap of its shell. Many scallops have been observed with shells partly drilled, showing that in this way they have escaped destruction.

These two enemies are found in certain areas in great abundance, and only here is the damage to the scallop at all apparent; in other localities scallop is relatively free from natural enemies.

XX. *What are the principal destructive agents?*

Under the broad term of "adverse physical conditions" can be grouped the principal causes of scallop destruction. The small seed are the chief sufferers. Although protected by their attachment to eel grass by the byssus (a bundle of fine threads), scallops are constantly in danger of washing ashore in heavy winds. Enormous sets of scallops are found where the flats are exposed or nearly exposed at low course tides, causing sometimes entire destruction during the winter. Eel grass, which serves as a protective medium at times, hinders rapid growth, and many scallops are covered by masses of dead eel grass.

In nature there is everywhere this struggle for existence. The scallop in the past managed to live only by overcoming these adverse conditions. When man intervened by killing both the adult and the seed scallop, it became harder to meet these conditions, and the natural result was a diminishing supply. The outlook for the future is bright, if man will refrain from taking the seed scallop.

Outline of Early Life History.—(a) How the eggs are laid: The scallop is hermaphroditic, *i.e.*, the same animal is both male and female. If a scallop is examined during its spawning season, one may notice a bright, orange-colored sac, lined with a thin streak of white, which composes most of the lower part of the main body or visceral mass. The orange-colored part contains the eggs; the white

part, above the orange, the sperm. When ripe, the eggs, $\frac{1}{400}$ of an inch in diameter, are extruded into the water, where they are fertilized by the sperm cells, usually from another scallop.

(b) Embryology: Eggs were artificially fertilized June 12, 1906, at Monomoy Point. After fertilization the egg passes through a series of changes by the usual method of irregular cell division, until it becomes, in about fifteen to twenty hours, a small larva, swimming by means of little, hair-like processes, called cilia. In the next few hours it develops a flagellum, a bundle of long, fine hair-like processes, which is used as a feeler. The part near the flagellum is now covered with cilia, while the opposite end has none. Soon the shell begins to form, and the scallop enters upon the so-called veliger stage.

(c) Veliger stage: At this stage the embryonic shell is fully formed, and encloses the entire body. The animal is still free-swimming, locomotion being effected by the organ called the velum. The cilia of the former stage have been modified to a circular band with the flagellum in the center, thus forming the velum. This is extended when the shell is opened, and by the lashing of the circular fringe of cilia the scallop veliger can travel through the water in any direction. When startled, it immediately closes the shell and drops to the bottom. The diameter of the veliger is $\frac{1}{250}$ of an inch.

(d) Crawling stage: A gradual transition now takes place, the veliger changing so that in less than three days it arrives at what may be called the crawling stage. The velum has now disappeared, and in its place is a foot, which becomes relatively the largest part of the body. The foot possesses a groove or sucker at its end, which is also equipped with long cilia. By means of this foot the scallop can both swim and crawl, making relatively fast progress. At first the size of the footed scallop is scarcely larger than the veliger; development becomes more rapid, and the scallop soon attains a length of $\frac{1}{50}$ of an inch in diameter.

(e) Attachment stage: Although the crawling stage cannot be said to come to an end until the scallop measures at least half an inch in length, it soon acquires the power of attaching itself to any object by a byssus thread. As it increases in size, the number of strands of the byssus increases. The first scallops noticed attached were $\frac{1}{50}$ of an inch in diameter. Possibly they may have the power of attachment still earlier. The attachment is very strong, and it is difficult to dislodge small scallops, though they are able to cast off the byssus at will and in a short time spin another. During the late crawling and early byssus stage the eyes and tentacles are developed. Growth now becomes exceptionally rapid. The power of byssal attachment remains with the scallop all its life. Often scallops fifteen months old are found attached to eel grass. This habit is of use chiefly in preventing the animal from being washed ashore in heavy storms. The foot

gradually decreases relatively in size, and the scallop loses its crawling power.

Spat Collecting. — Young scallops are usually found attached to eel grass, shells, stones, etc., by their byssus threads. The exact conditions which govern a set in any locality are difficult to observe. The primary requisite is something to which attachment may be made; this is usually eel grass. In a number of cases heavy sets are found in the still water on the side of a current. This is often the case at the entrance to harbors, where eel grass flats line the channel. The spread of the incoming or outgoing waters carries with it the young larva, which strikes the eel grass in the still water and sets. It is the instinct of the young scallop to fasten to anything it strikes. Scallops are attached to eel grass from 2 to 12 inches from the bottom. As a rule, the scallop remains constantly attached until it has become even $1\frac{1}{2}$ inches in length, or practically until the first winter. From that time on it can attach itself, but appears rarely to make use of this power. This merely gives a suggestion for artificial spat collecting, if such were found desirable. Old nets, frayed ropes, etc., hung in a moderate current, should furnish an excellent means of collecting spat. At present there is no distinct need of this, as "seed" is superabundant in many localities. Although scallop larva were plentiful no natural set occurred during the summer of 1906 in the Powder Hole at Monomoy Point. Nevertheless, on boxes and frayed rope, lowered for collecting spat from a raft anchored in the center of the Powder Hole, 1,200 small scallops were obtained in the limited space of a few square feet of surface.

Quahaug (Venus mercenaria).

In the last few years the fact that our quahaug supply is rapidly diminishing has frequently been called to public attention. The full significance of this has been overlooked and not thoroughly understood. It means practical annihilation of a valuable industry, if something is not done to check this diminution, which is shown by the high price now paid for the choice "little neck" (a small quahaug $1\frac{1}{2}$ to 2 inches). The increasing demand and popularity of this shellfish has caused a severe drain upon the natural beds, from which the small quahaugs are being taken.

As the situation now stands, there is a distinct need of a remedy. Two possible means suggest themselves: either regulate the capture, in view of preserving the future industry, or increase the supply through cultural methods, to meet the increasing demand.

It is hardly necessary to emphasize again the necessity of a complete knowledge of the life and habits of the quahaug, before satisfactory laws, regulations and cultural methods can be devised.

The quahaug work during the past year has followed out in detail the points suggested by Prof. J. L. Kellogg in his excellent work,

"The Growth and Feeding Habits of *Venus mercenaria*," which is the only publication upon the quahaug. For conciseness, a summary of certain points will be put in the form of questions and answers. This is by no means to be considered as the complete report, but merely an outline, to show the general trend of the year's work.

Methods of Work.—The quahaug work was mainly conducted at Monomoy Point, where a variety of conditions could be obtained in a small area. Experiments were conducted in beds, and in boxes either suspended from a raft or resting on the bottom. It was found more satisfactory to use boxes filled with sand for the experiments which demanded monthly records.

Experiments were conducted under a great variety of conditions on the same plan as the soft-shelled clam experiments, though on a much smaller scale. Growth experiments were laid out under such conditions as: (1) in rapid and slow currents; (2) in eel grass; (3) on muddy bottom; (4) on sandy bottom; (5) between the tide lines, with a view of determining the best conditions for growth.

Beds were planted at Nantucket, Monument Beach, Essex River, Ipswich River and Monomoy Point. In these beds were planted all sizes, from $\frac{1}{4}$ of an inch to 3 inches. About 5,000 quahaugs are under observation.

Growth Experiments.—Methods of recording growth are: (1) measuring length; (2) water displacement; (3) notching the edge with a file,—a method used with much success on the soft-shelled clams by Dr. A. D. Mead of the Rhode Island Fish Commission.

I. *How long does it take a quahaug to reach the size of a "little neck"?*

The rate of growth of the quahaug varies according to its location in respect to current, tide and other physical conditions; therefore, the following answer will not apply in all cases. The answer applies to quahaugs under favorable conditions for growth.

A quahaug will reach the size of 2 inches under naturally favorable conditions two years and three months from the time it is spawned.

An average taken from several favorably located growth experiments gives the following results:—

Spawned July 15, 1904.

DATE.	Size.	Equivalent in Inches.
Oct. 15, 1904,	13 mm.	.43 inch.
Oct. 15, 1905,	34 mm.	1.275 inches.
Oct. 15, 1906,	54 mm.	2.04 inches.

From this down the rate of growth diminishes according to the favorable or unfavorable location of the bed with respect to natural

conditions. In the most unfavorable experimental bed, one where the eel grass cut off all current, it would have taken eight years to produce the same-sized quahaug.

II. *How old are the large quahaugs?*

The answer to this can only be an estimation. Large quahaugs over 3 inches must be at least four years old. Without doubt 3-inch quahaugs can be found at any age over four years, according to their favorable or unfavorable location. At present the length of life is unknown.

III. *What is a blunt-nosed quahaug?*

In the market there is a distinction in value between "blunts" and "sharps." A blunt nosed or lipped quahaug is one whose edges have thickened because of slow growth; while a "sharp" ordinarily indicates rapid growth.

IV. *What are the conditions that influence the growth of the quahaug?*

(a) Food: The rate of growth among the mollusk family, to which the quahaug belongs, depends directly upon the amount of food. Ninety-eight per cent. of this food consists of microscopic plants, called diatoms, and is taken from the water. As a rule, these forms are rather evenly distributed through the water. The quahaug draws them in by a short, fleshy extension of the mantle called the siphon.

(b) Current: Current does two things, according to Prof. J. L. Kellogg, the eminent authority on clams: it keeps the surface clean, and more food is brought over the beds. Therefore, it should be expected that quahaugs situated where they get the best current (the current cannot be too strong) would grow the best. In every experimental bed this fact has been demonstrated. The best growth comes from the beds which have the best current and most continuous circulation of water. More food passes over these beds, and consequently growth is more rapid.

(c) Soil: Quahaugs are found in mud, sand, mud and eel grass, and various combinations of these three. Ordinarily quahaugs are found on the muddy flats, below low-water mark. In regard to the rate of growth, the chief essential is the food. It has been found that mud flats furnish more food than sandy flats. The soil alone affects the quahaug mechanically as a resting place; chemically by its effect on shell; or by a prolific growth of diatoms, which may increase the food supply. The quahaug grows equally well in either mud or sand, though a muddy flat has more often a slower current.

In eel grass the growth of the quahaug is less rapid, unless situated where there is a current. As a rule, the eel grass shuts off circulation of water; therefore there is less food where the current is not strong. Eel grass is situated usually where current is not swift, and prevents, or retards still further, the circulation of any current. The quahaug grows only slowly in eel grass.

Quahaugs set in eel grass more frequently than on other flats. The eel grass furnishes a place for the young quahaug to set before it enters the soil; it affords protection to the young against transplanting power of currents. If a quahaug when small strikes any obstacle, such as eel grass roots, it is likely to remain there, never wandering.

V. *Does a quahaug grow between the tide lines? If so, how fast?*

Quahaugs are often found between the tide lines. Growth is much slower than on flats continually submerged. Growth was found by experiment to average a little more than half that gained by quahaugs continually submerged under similar conditions. Naturally, the growth between the tide lines varies from the same causes that affect the submerged beds.

VI. *Does the density of the salt water affect the growth of the quahaug? If so, what degree of salinity is most desirable?*

As far as can be yet observed from our experiments, the density of the water does not affect the growth. It is not as sensitive to density changes as the oyster. The quahaug, as the soft-shelled clam, grows equally well in very salt water or in brackish water, *i.e.*, water of specific gravity from 1.009 to 1.025.

VII. *Can quahaugs grow out of the sand or mud? If so, how can this be of economic importance?*

Quahaugs will grow suspended in wire baskets in moving water. Growth is one-third as fast as quahaugs in sand under the same conditions; therefore, a man would not lose entirely by keeping his catch in racks under water.

VIII. *What are the growing months of the quahaug?*

The following table has been obtained from monthly observation of numerous quahaug experiments under the best growing conditions. The months are weighted, each figure representing the gain during that month in millimeters (25.4 mm. to the inch), starting May 1.

May,	3	November,	1
June,	3	December,	—
July,	3	January,	—
August,	5	February,	—
September,	4	March,	—
October,	4	April,	—

IX. *When is the spawning season?*

The spawning of the quahaug is at the same time as the scallop, — middle of June to middle of August.

X. *What are the natural enemies?*

The principal enemy of the quahaug is the “cockle” or “winkle” (*Lunatia duplicata* and *heros*). This enemy destroys the quahaug by drilling a clean, counter-sunk hole in the quahaug shell by a rasping, boring instrument. This hole is nearly always found in the same place in the shell. The very small quahaugs are occasionally found bored by the oyster drill (*Urosalpinx inerea*). Starfish have been found eating

quahaugs. The starfish rests on the ground over the quahaug, which lies just below the surface of the sand.

XI. *Do quahaugs migrate?*

In beds which have been left a year the quahaugs have not moved at all; all were found in a radius of a few feet from where planted. This substantiates Professor Kellogg's observations. In experiments on this point this conclusion has been reached: the adult quahaug has the power of movement, but does not seem to exercise it.

Outline of Early Life History.—The egg of the quahaug is shot out into the water, where it is fertilized. Development takes place rapidly, and the animal soon reaches a swimming stage (veliger), with a shell which has formed during this time. A few days later a foot is completely developed, the swimming organ is discarded, and the animal enters upon a crawling stage. Soon it attaches itself by a thread from a gland of the foot, fastening itself to objects either out of the sand or to sand grains. As in the case of the soft-shelled clam, it frequently casts off this byssus, and moves, spinning another at will in a very short time. This is the first time the byssus has ever been observed with the quahaug, though its existence has been surmised. In every detail the byssal stage of the quahaug is identical with that of the clam, as the quahaug digs into the sand and anchors itself to the sand grains in its burrow. The object of the byssus, as in the case of the clam, is for protection against being washed out of its burrow. Quahaugs have been found, 3 mm. in diameter, fastened by byssus to objects out of sand. The byssus has been observed on quahaugs 9 mm. long. Quahaugs over this size seem to lose the power of byssal fixation, or do not make use of it.

Spat Collecting.—While no very satisfactory method has been found, a number of this year's set were caught in boxes filled with sand and suspended from a floating raft in July and August. A similar method has been used by Dr. Mead in connection with clam spat.¹ It furnishes an idea for further work along this line.

Artificial Culture.—The most favored places for quahaug growth are where there are currents. Advantage can be taken of this by placing quahaugs in boxes or racks, suspended from rafts or piers. The quahaug can be made to grow in boxes containing only a few inches of sand, possessing thus a great advantage over the clam in this regard, as the clams demand at least 10 inches of sand.

The advantages of this method of artificial culture are: (1) faster growth (quahaugs can be taken from slow-growing places); (2) non-trespassing on public rights; (3) utilization of place not hitherto used; (4) the market demand as to size can be exactly met; (5) quahaugs thus raised will grow when very thickly planted; (6) quahaugs grow well in water of any depth,—utilization of all water.

During the past summer, experiments in artificial quahaug raising

¹ Rhode Island Fish Commission report, 1899.

have been made from a floating raft. Boxes containing sand and quahaugs were lowered to various depths; monthly records of each box were made. Quahaugs were planted in various numbers per square foot; results were very favorable, — growth was very rapid, far more so than on shore. Quahaugs grew as well thickly planted as when less numerously. They could be made to gain an inch in length in five months during the summer.

This scheme of artificial culture is practical and profitable, economizing waste space now of no economic importance.

A complete account of this method of artificial culture and experimental results from the same will be given in the regular quahaug report, to be published next year.

Oyster.

The work of the past summer upon the oyster was confined to main lines: (1) growth experiments and observations of set were conducted at Monomoy Point; (2) several small beds were seeded on the north shore, with a view of determining new suitable places for oyster culture; (3) a survey of the oyster area of the State was included in the general shellfish survey. The results of these investigations will appear in next year's report.

There are two suggestions which I should like to bring before the commissioners concerning matters which have come to my attention during the past year: the first, the increasing interest of the public in the development of the shellfisheries; the second, the duty of the town to its shellfisheries.

1. The last few years have shown a decided change in the attitude of the general public toward the shellfisheries of the State. The importance of this movement can not be overestimated. Present conditions are calling the attention of the consumer to the decreasing yield, and only through the consumer can legislation be enacted for the improvement of the declining shellfisheries.

Since the Department of Fisheries and Game has become not merely a commission on inland fisheries, but through the efforts of the late Captain Collins likewise a commission of sea fisheries, the confidence of the fishermen, and through them the confidence of the general public, has been steadily on the increase.

The past year has shown remarkable strides along this line, especially in the added interest in the experimental work now conducted by the commission upon the shellfisheries. Everywhere along the coast the kindest reception has been given the employees of the commission, and in many cases also help through which they were able to accomplish results otherwise not attainable.

The intelligent consumers as well as the fishermen in the State should realize that in the next few years active and intelligent methods must

be used to save the shellfisheries from practical annihilation. The commission can show cultural methods and indicate the way of reform, but no more. The future of the shellfisheries lies in the hands of the voters of the towns of the State.

2. Several years ago the State by a special act (Acts of 1880, chapter 200) placed the control of the shellfisheries in the hands of the towns. In doing this the State placed a great responsibility upon the town, namely, an intelligent supervision of its own shellfisheries. One matter was overlooked, — the State made no provision for forcing a negligent town to care for its own shellfisheries.

It is a self-apparent fact that our shellfish are steadily decreasing, as the result of unintelligent and unsystematic methods of capture. The towns are mainly responsible for this. As each town was given complete control, it was the duty of each to regulate its own shellfisheries. Better control is what is needed at the present day.

As an instance of such a lack of foresight respecting the shellfisheries, the following case is an excellent example. In a certain Massachusetts town in the spring of 1906 there was an enormous set of small quahaugs, from $\frac{3}{4}$ to $1\frac{1}{4}$ inches. By the spring of 1907 these would have been good-sized "little necks," and, as has been experimentally shown, would have increased to six or seven times the volume. Nevertheless, these were gathered and shipped *out* of the *State*, to oystermen who merely replanted, reaping a rich harvest. The result was a financial loss of large amount to the town, merely because it neglected to regulate this indiscriminate digging by enforcing a simple size limit.

While many towns have regulated their shellfisheries in an efficient manner, there are some that have made no effort to care for theirs. It is only justice to the State and general public that such towns be compelled to put a stop to economic waste, and thus to revive this declining industry.

Respectfully submitted,

D. L. BELDING,
Biologist.

The following report upon the soft-shelled clam is merely preliminary to the one of next year. In this we have given in the briefest way a résumé of the life history of the clam. Rates of clam growth as regards exposure, currents, soils, ages, etc., have been set forth as facts; the account of the experiments will be furnished later. But, as regards clam culture, in methods of preparing the soils, and in procuring and transplanting the clams, we have gone more into detail. Yet here the length of time demanded for successful experiment, and the uncertainty of practical results, prevent many definite statements. We wish

the clammers and all those interested in clam culture to discuss thoroughly what is written along this line. We are collecting all available information upon the subject of clam culture.

REPORT OF J. R. STEVENSON UPON OBSERVATIONS AND EXPERIMENTS
ON MOLLUSKS IN ESSEX COUNTY DURING 1906.

I. *What is the spawning season of the soft-shelled clam (Mya arenaria)?*

The times of spawning vary greatly with the locality. (1) Upon the shores of New Jersey, the clams are said to spawn during the months of May and early June. (2) In Narragansett Bay, June is the month (report of Rhode Island Fish Commission for 1901). (3) At Chatham, along the south shore of Cape Cod, the spawning takes place largely during July, though some larvæ are found in August and even in September. (4) At Plymouth there were large quantities of clam larvæ in the towings during the first week of August; during the last week of October a small number were found. At this time there was a uniform gradation of set, from $\frac{1}{40}$ of an inch in length to more than $\frac{1}{2}$ an inch. The clams had been in spawn all these weeks. During August the season was at its height. (5) In Ipswich I found no larvæ from the towings before August 23. Even in the middle of November there were clams upon the Ipswich flats less than $\frac{1}{10}$ of an inch long. Here the spawning season is at its height during the first half of September. (6) The time of spawning at Newburyport and at Essex is practically identical with the time at Ipswich. (7) The farther north one goes along the coast, the later is the time of spawning. (8) It is said upon high authority that the spawning of the clam in the Gulf of St. Lawrence does not take place until the end of September and early part of October.

Thus it is seen that there is a difference between the time of spawning at the northern range of the clam and upon its southern extension of at least four months. Within the boundaries of our own State the spawning season at Fall River upon Narragansett Bay is two and one-half months earlier than the time of spawning upon the Merri-mac in the extreme northeasterly part of the State. The time varies with the locality.

The temperature of the water is the main factor in regulating the time of spawning. The warm currents along the southern extension of the clam give a higher temperature to the water during the entire year, and especially in the early spring they render the water warm enough for the spawning to commence very early. The farther north one goes, the greater becomes the retarding influence of the colder climate and the northern currents.

Upon the clam flats along the south shore of Cape Cod, as at Monomoy or Harwich and farther south, where the ova are extruded

early in the summer, there is usually a lesser spawning in the fall months. Upon these flats we find two distinct sets each year. This makes it most difficult to determine the age of any set of clams that have reached sexual maturity. Along the North Shore, due to the lateness in the time of the first spawning season, there is no such second spawning season.

Moreover, in each locality the clams do not spawn at the same time. By November 1, when the clam larvæ in the towings have become very few, it is possible to find, upon the same flat, "clam set" more than 1 inch long, as well as less than $\frac{1}{10}$ of an inch in length, with all the intervening sizes. The average length of "clam set" in Massachusetts waters north of Cape Cod by November 1 is about $\frac{1}{2}$ an inch. In each locality there are some clams that extrude their eggs early in the season, and others toward the close. Finally, each individual clam extrudes its eggs during a period extending over some weeks. If a mature female clam is examined early in the season, it is found to possess ova in all stages of development. So it is with the males; mature spermatozoa, as well as sperm still in an early stage, are found in the same individual. After a fortnight one finds, it may be, few immature ova in a female clam, the larger number being ready for extrusion; but the whole number of ova less than earlier in the season. Later but a few mature ova may remain; the spawning season has passed.

For each individual clam the time of spawning extends over a period of some weeks. For the clams as a whole upon some one flat, or within a certain harbor, the spawning is spread over a period of two to three months,—its beginning, its height, its waning. For all the harbors along the coast, containing clams, the spawning season extends from May to November,—a period of six months. Thus there is apparent the utter impossibility of formulating any general rule as to the spawning season of *Mya arenaria* along our coast. Each harbor has its own time.

In regard to the spawning of the clams there are many difficult questions that should be answered: (1) Do the clams upon a mud flat spawn before those upon a sand flat? (2) Which spawn in the briefer period? (3) Which extrude the greater number of eggs? (4) Do the small clams spawn earlier than the larger ones? (5) Does the position of the clams upon a flat with reference to high tide affect the time of the spawning season or the number of eggs extruded? (6) Upon flats of varied texture how old must a clam be before it attains to sexual maturity? Several of these questions are briefly discussed in the 1901 report of the Rhode Island Fish Commission. Some of the material we have thus far collected in regard to these questions does not entirely confirm their findings. We wish to report in detail upon this subject another year. Then, too, very little is known as to the development of the ova and spermatozoa of the

Lamellibranchia, and the method of fertilization for the clam in particular. A vast field is here opened up, even for generalized work.

The direct bearing of all this study lies in the fact that it may be necessary for the towns to set apart certain areas in the several harbors for brood grounds of the clam, as is now done with regard to the oyster; or at least to restrict digging over certain localities, whence barren areas may be seeded naturally. The value of such localities and those that are most suitable must be fully understood.

Our work with regard to the early stages; the study of the causes and conditions and rate of later growth, and of the depredation of enemies and the protection afforded by friendly forces,—all of this work must be carried out, at least to some extent, before a sufficiently adequate knowledge of the soft-shelled clam is obtained, in order to gain its maximum production within the harbors of our Commonwealth.

Practical Methods of Clam Culture.

When clams have ended their free-swimming stage, they may set far more thickly on one part of the flat than upon another. On one area the young *Mya*, no longer than $\frac{1}{10}$ of an inch, may be found 1,000 per square foot, while within 10 yards 10 clams per square foot may be scarce. On some flats the set is never very thick (*i.e.*, more than 100 per square foot) on any part, while a light set may be found upon almost the entire flat. As a rule, for two or three months after spawning has begun the set is very numerous upon some small portion of a flat, and scarce upon the greater part.

(1) This uneven distribution of the young set is of the highest importance to the transplanter. The clams, destined during the winter storms to cover the entire flat, are now set within a small compass. Nine-tenths of his labor has been done for him. Even with the set over 1,000 per square foot, it is no easy undertaking, however, to obtain it clear of sand and debris. The first gathered for experimental purposes were too small; the strong byssus thread of the attached *Mya* held it fast to the soil. Later, when near the half-inch mark, the byssus becomes a relatively unimportant organ and readily breaks. This is the time for collecting. Shovel the surface sand containing the set into galvanized mosquito wire sieves, and vibrate under water. The sand and mud readily sink, leaving the young *Mya* white and clean. Often by one sifting with a sieve 18 inches square, 3,000 to 4,000 young clams are obtained. This is tedious work, and frequently the clam set is far from the water at low tide, necessitating a long portage, or else the digging of holes near at hand. Often sifting is most successful when the water is leaving, or else flooding, the flats.

(2) At times we may use an easier method of collection than the one just described. In some limited localities the young clams have set in unusually large numbers. Often they are so numerous, 2,000

to 5,000 per square foot, that only a small portion can burrow, the rest being but half in the sand, or merely resting upon its surface, the sport of every storm. Such an area I found during November, 1906, in Plum Island Sound, upon the east side of Rowley Reef. The narrow channel here washes the eastern thatch bank. Upon the west side of this channel a long reef has grown up, upon which lay the prodigiously abundant set. Several clammers have told me that frequently such sets occur here, furnishing extraordinarily good digging for the Rowley men. Upon an area 600 to 700 feet long, tapering at the ends, and about 150 feet wide in the center, I found a set of young clams from 1,000 to 5,000 per square foot. From an average square foot of sand in which every clam was burrowed out of sight, and in which I counted roughly 1,000 holes, I dug 1,937 clams, averaging about $\frac{1}{2}$ an inch in length. From a square foot of sand into which the clams had not completely burrowed, I sifted 2,416 clams. Roughly estimating this area as containing 50,000 square feet set with clams at least 1,000 per square foot, we have the enormous amount of 50,000,000 young clams. If they go as I found, about 3,000 per quart, there are about 17,000 quarts, which is over 500 bushels of young clams. The producing power, after two years' time, of these 500 bushels we may scarcely estimate. From certain productive flats less than 500 two-year-old clams filled a bushel basket. This young set on Rowley Reef goes 100,000 per bushel. If all were thriving after two years we would find a gain in volume of 160; *i.e.*, if to-day we were to plant 1 bushel of this set, within two years we would be able to dig over 160 bushels of fair-sized, marketable clams. Many of these clams, even if carefully transplanted, would die; yet, if but a half survive, the gain in volume of even 80 bushels is enormous,—far greater than in areas naturally set, for the natural set is most uneven in its distribution, certain areas being extremely overcrowded, others scarcely occupied.

Among the peculiarities of this set there were no enemies to be found with the clams, and no other shellfish,—neither Gemma, Macoma, Mactra, Tellina, Ensis, Lunatia, Littorina nor Nassa; it was a set solely of clams. Of all these clams, I could not discover one that was fastened by its byssus thread. Perhaps a recent storm, through violent shifting of the sand, had destroyed the byssus threads of all.

Upon the shifting sand of the top of Rowley Reef very few clams could be found, but upon the boundaries of this thickly set portion of the reef the young clams spread out in decreasing numbers over an extensive area. This lesser and more scattering set increases perhaps by 50 per cent. the number of young clams upon this reef. Near the center of the most thickly set area I found a tidal pool, roughly 12 feet long by 6 feet wide, and about 15 inches deep. At first sight it seemed but an inch or two deep, but upon wading into it I sank to my knees. Imagine my surprise when I found it was not mud into

which I sank, but a groaning mass of living clams. Here were more than 60 cubic feet of solid clams. Reckoning 2,000 per quart, as these seemed larger than those burrowed into the sand, with 25.7 quarts per cubic foot, I found in this one pool more than 3,000,000 young clams. With this discovery the work of transplanting was more than nine-tenths done. Upon other portions of this thickly set area were many smaller hollows, set full of young clams, layer upon layer, tier upon tier, till the former sand hollows now became ridges of living clams. These ridges we "scooped" up by the pailful.

The first day I visited the reef I dug a short trench, about 15 feet long, across a portion of this thickly set flat. The day following I found several pailfuls of young clams gathered by the force of the water into clean heaps. When such natural tide pools fail in their supply it is possible to dig others, and, by turning over the thickly seeded flat, to let the tides and waves fill the new pools with the dislodged clams. Those found in the bottom of the large tide pool were in poor condition; a few were dead; some were dying; they had been left there too long before transplanting. I hesitated to use these clams only, and so by careful sifting obtained several bushels from the thickly set ridges and from the thoroughly burrowed areas. Two bushels I transplanted to the barren flats abreast of Hog Island in the town of Rowley, and sowed them in soils of several kinds. Two bushels I transplanted upon the north portion of Point Peter, where were few large clams and practically no young set of 1906. We sowed two bushels upon "Lufkins," abreast of Ipswich Bluffs, just south of the north guzzle and well out upon the flat. The day following two bushels were distributed along the west side of Treadwell's Island, upon lower Senorita, and upon the Horseshoe opposite Diamond Stage,—all in Ipswich River. Some of these spots are poor for transplanting, but for the sake of the experiment we wish to try them all. During the winter and spring of 1907 we plan to keep close track of this Rowley Reef set, and of the areas upon which we sowed the clams.

(3) There is still another method of transplanting that may be used. When a strong wind is blowing, visit a thickly set flat, such as Lufkins or Ritchies Ground, in Plum Island Sound, upon which the waves raised by this wind beat directly. As the tide begins to flow, turn up some portion of the flats just in advance of it. The big incoming waves wash the clams from the heavier sand, and slowly roll them up the beach in ever-increasing numbers; finally, one may gather them in windrows.

(4) Many men, as at Essex, dig for transplanting small 1-inch clams that have set upon the mud flats in great numbers. This method is much more tedious, and the increase in volume for the amount transplanted is many times less. But for certain shifting flats this is the only method, for clams less than 1 inch in length do not remain

where planted in these areas. There are some very shifting flats that can be planted only with clams longer than $1\frac{1}{2}$ inches; yet when once seeded the growth upon these areas is most rapid,—ample to reward the transplanter.

The clams from these overset areas are more than enough to seed all the barren flats now upon the sound. Here are four suggested methods. They may be used, or others devised. At any rate, by very little effort, the supply of clams can be increased greatly to meet the ever-growing demand. Thus, by utilizing the huge sets found in various localities, the labor of collecting and transplanting young clams of suitable size is rendered comparatively easy.

Two objections to clam transplanting discussed:—

(1) It may be said by some that huge sets of the soft-shelled clam do not occur in every harbor, especially in the smaller ones, of the State; also, that these sets are not found every year, even in the most favored localities. (a) But the clammers declare that Rowley Reef sets thickly every few years. They tell of huge sets in other years upon other flats of the sound. (b) During the fall of 1905 an extensive set came upon Dumfudgeon in Squam River. (c) The Rhode Island Fish Commission, in a report published in 1902, mentions numerous sets under varying conditions,—in 1899, from a certain area on Cornelius Island, 12,000 clams per square yard were dug; in 1900 many thickly set areas were located, from which clams were transplanted; during August, 1901, on Green's Island, a huge set, in some spots going nearly 8,000 clams in one shovel full of sand, was visited several times, a portion of it being dug and transplanted to other flats. (d) Prof. J. L. Kellogg of Williams College, in a recent report has described admirably a most peculiar set in Falmouth, Mass. (e) At Harwichport, in a certain portion of the harbor, a thick set of 1906 was found. (f) Upon Wheeler's and Castle Neck flats in Ipswich an exceptionally heavy set occurred,—several hundred per square foot, in some cases. (g) The clammers in other harbors tell of huge sets cast up in windrows along the shore (a Rhode Island report has described such a set). Though it may be unusual to discover clams so exceedingly numerous as this set upon Rowley Reef, I have no doubt that in practically all the harbors of the State, where clams survive in any number, these extremely thick sets occur. It is true that they may not be found in the same place each year, nor in the same abundance; but they do occur in sufficient numbers to render the work of transplanting possible and practicable. During the coming spring and summer we plan to continue our observations in the harbors of the State, with a view to locating these abnormal clam sets, and to experiment in transplanting them to the barren areas of these harbors.

(2) Another problem in regard to transplanting to other areas consists in the fact that many flats are suited to the successful raising

of clams only after the clams have reached a certain size. If the young clams are planted before this size is reached, the beating of the waves and the shifting due to current action wash away the clams to other areas, leaving the flat almost as barren as before planting. In May several experiments at Plymouth, as well as a bed in Squam River and several in the Essex basin, failed for this reason. Many flats, mainly those where the current is relatively gentle, may be seeded profitably in the fall; but the more sandy flats cannot be planted with success till well into the succeeding summer. I have no doubt that some areas, over which strong currents run, should not be planted till the seed are over one year old. Such shifting areas may be planted most profitably, even though only larger clams may be used, because here, due to the very swift, food-bearing current, growth is extremely rapid. I have in mind one such spot in Plum Island Sound, where a clam which last April measured 1 inch had by the latter part of October become more than 3 inches in length. These spots might well be named clam-fattening areas.

II. *What is the cause of this enormous set upon Rowley Reef?*

You will notice by this rough sketch of Rowley Reef that the main channel of Plum Island Sound takes a bend of nearly 150° just east of the reef; in fact, this huge bend in the channel has built up the reef. Upon the eastern or convex side of the channel there is slack and shallow water. Right here is the huge set. A swift, larvæ-bearing current is suddenly checked; the larvæ, as well as the sand grains with which they are found, are deposited in the slack water, thus extending the reef ever to the eastward, as the channel advances yet farther east, exacting its annual tribute from the thatch. Upon the top of the reef the waves from the west beat with force too great to permit any permanent set; but upon this eastern side the waves do not exert sufficient power to dislodge the set, which remains and thrives. A larvæ-bearing current, suddenly checked by some obstruction, causes the set of the young clams upon Rowley Reef, as elsewhere upon the tide flats of the State.

The Localities upon which is found an abundant Set.— Every distinct flat has at least one area that is thickly set by young clams for two or three months after spawning. During the past year we have studied more than a dozen Ipswich flats, with a view to noting the localities upon which is found the abundant set, and to explaining the cause of this set in these special localities. We plan to continue this work during the winter and spring of 1907, and in a more complete report to describe in detail, with the aid of maps and photographs, the locations of and variations in the set upon the several flats.

(1) Early in November on Lufkins I found one thickly set area, a couple of acres in extent, containing from 500 to 1,000 clams per square foot. The outgoing tide gently washed the southern edge of the flat, causing a bend in the current and giving slack water. Here

I found the set. Elsewhere it was very scarce. Though upon the muddy parts of the flat I could find almost no set, yet in this same mud clams one year old are growing in huge numbers. I believe that they did not set in this mud, but that they first came where now I find so many of 1906, and that during the winter and spring storms they were shifted to the inner portions of the flat. I believe that this 1906 set, so numerous near the bend of the current, will likewise shift. There is a portion of Lufkins, the outer middle area, upon which clams are very scarce at any time of the year. Here the current is greater, the food supply larger; here are needed the efforts of the transplanter to double the yield of this productive flat.

(2) Upon Foresides, the western part of Plum Island Sound middle ground, we find a heavy set, not so numerous as upon Rowley Reef or Lufkins, but over a large area. This is a typical flat; no shifting sand dunes interfere. To the west near the low tide is the coarser sand, high-reefed, and shifting at every storm. Here clams grow most rapidly, but they shift too much; here the young set is scarce.

Within these shifting sand reefs we find a smoother, more stable portion of the flat of finer sand. Here the clams of all sizes are numerous; the growth is rapid,—nearly as rapid as upon the reef. Here we find the abundant young set. Early in November, 1906, I found set ranging from 2 mm. to 20 mm. and more. This area is primarily the home of the young set of the clam, as well as of the mature forms,—a smooth flat of fine sand, between the areas of coarse sand and soft mud.

Within this well-set area, towards the thatch bank, we find mud with very fine sand,—a heavy flat. Here the young set is scarce; here is the home of the *Macoma*, old and young; here clams one and often two years old are abundant; here there is no shifting, but the growth is comparatively slow. Upon this muddy area the clams are shifted from their first lodgment by the storms of winter and of spring.

Upon this flat the assistance of the transplanter is needed to collect the clams sufficiently large to be sown upon the outer shifting and sandy areas, where set is scarce, but growth extremely rapid. The transplanting should be done during a poor run of tides, when no storm is in sight, to insure that the clams have firmly burrowed before any shifting occurs. Thus the outer area of Foresides has a current too swift and unchecked, the inner portions too slow a current, for a numerous set; but in the central parts the currents are of sufficient force, yet checked enough by thatch projections and sharp bends, to induce an ample set.

(3) Upon Northeast Sides of Plum Island Sound Middle Ground, where the current takes a sharp curve, there is a very heavy set over a small area, for the flat is small, and high as well. The set seems

never to shift here, where I find clams of all ages closely crowded into a comparatively small area. The portions of the flat about this set are lightly seeded. Here the transplanter is needed.

(4) Lobster Cove contains a set due to a strong eddy that sweeps around the flat, leaving very soft mud upon its center. Along the edges of this soft mud in quiet water the set is found. It is scarce upon the borders of the flat and lacking in its center. The same cause for the set obtains here as upon the other flats, — moving water is suddenly checked. I might describe several other flats, well set, but in some parts very poorly seeded, all showing how small is the area upon which the clams set, and how large the area upon which very few clams survive, — not nearly as numerous as should grow upon it. Upon all the areas of this most productive harbor in the State there is a great need of judicious transplanting, in order to increase the production of clams.

III. *Are all the flats set at the same time?*

No; some are set more than a month before others. While young clams were setting continuously upon Foresides from August till November, Lower Reef, across the channel to the westward, was barren till the largest Foresides set measured about $\frac{1}{2}$ an inch in length, about October 1. Then a very heavy set covered Lower Reef. North-east Sides was seeded some weeks later than Foresides. The north part of Castle Neck Flat set several weeks later than the southern part. The set upon Lufkins covers an area rather small, as compared with the set area upon Foresides; also, the set is somewhat later. Wheelers was thickly covered comparatively early in the season.

During the year 1906 very few young clams came upon the river flats of the North Shore; as far as I could examine Ipswich, Green, Rowley and Merrimac rivers, there was only a decidedly scattering set along their banks. Upon the sound flats it is very heavy this year. Will the set another year be light upon the sound flats, and thick along the rivers?

IV. *Is the area for most favorable growth of the soft-shelled clam identical with the area upon which the thick set comes?*

As a rule it is; but the area of favorable growth is usually far larger than that upon which the heavy set is found. This applies to other genera of shellfish as well.

V. *Are there many clam areas below low water?*

It is rare that one finds clams in abundance below low tide; and this is mainly for mechanical reasons: (1) shifting sand, (2) soft mud, (3) eel grass and mussel occupation alike prevent clam growth upon most of the areas below low tide.

(1) As one approaches the low-water mark on a sandy flat the soil becomes coarser, more rippled and shifting. Below this mark the shifting increases, because of the increased force of the current when

the tide is down. For the same reason we find no clam areas exposed to the wash of the sea, though the flat be far below low tide.

(2) Often a muddy flat, though it produces good clams between the tide lines, becomes too soft for clam growth below tide lines. This is especially true of flats extending out from the shore of a large harbor,—flats where the current is extremely slow.

(3) In many tidal rivers much of the bottom is overspread by eel grass and mussel beds. These in many cases occupy ground below low tide, suitable for excellent clam growth; but the clams can gain no adequate foothold among vigorous eel grass areas and densely populated mussel beds.

(4) Clam areas of any extent below the low-tide mark that go to none of these extremes, undue shifting or very soft mud, or eel-grass and mussel occupation, are comparatively few. In the larger harbors some such areas are found. They occur mainly upon the banks of rivers (some distance from the sea), as along Senorita in Ipswich River, and in Rowley River in a few limited spots. The northern side of Joppa Flat Ground, upon the south side of the Merrimac, is an excellent type of a clam flat below low tide. At the lowest tides of the year the clambers dig numbers of big clams here, and they declare there are numerous "holes" upon a bright, quiet day. Upon the south side of Cape Cod, as in Buzzards Bay, etc., there is some "churning" of the clams below low tide. But the extent of these areas south of the Cape, as well as those to the north, is relatively limited, probably no more than 2 to 5 per cent. of the whole clam area of the State.

VI. *Such areas should be reserved as "brood grounds."*

Clams below low tide grow more rapidly than those between the tide lines. They are exposed during no portion of the day, and have as a rule a greater current. A number of experiments conducted the past year confirm this. Upon these limited areas clams of enormous size thrive in great numbers. Annually they extrude millions of eggs, which develop and settle upon the many flats. A chief reason why the outlook for clamming at Newburyport is so good is that the seeded areas below low tide remain in large measure undug. I believe that if Plymouth harbor possessed extensive clam areas below the low-tide line the present depletion of her flats would be far less.

Such areas, limited but extremely prolific, are imperatively demanded as "brood grounds." They should carefully be protected as an essential source of young clams, which are transported by the currents to all the flats of the harbor. The idea among many clambers, that if only they could devise a method of digging in firm soil at some depth below low water they would make "big money," should be lost sight of as soon as possible. The towns of our Commonwealth should look to it that the devices used at present in some localities

for digging below low tide, as well as new methods in such work, do not endanger the welfare of our clam industry. Where digging is constant, where the clams are decreasing in number, where depletion is threatened, the protection of existing brood grounds is demanded imperatively. If the sources of supply of young clams are disregarded during the next few years as they have been in the past, what have we to expect from our clam industry of the future? Here are a few productive localities where clamming is difficult; at least let us protect these.

Many further questions we wish to investigate more in detail during the coming year. Some of these are:—

(1) How fine may the surface of the flat be not to prevent a heavy set of young clams?

(2) At what period in the life of the young clams do they settle upon fine mud flats, or those of coarse, shifting sand?

(3) What per cent. of the swimming larvæ perish out at sea and do any enter other harbors?

(4) What per cent. of the larvæ set in unfavorable localities and die there?

(5) Is the set deposited by the outgoing and incoming tides alike?

(6) What per cent. of the clams spawn during the first year, and upon what flats is this per cent. greatest?

(7) What is the relative advantage of a sand flat over a mud flat as to clam growth?

(8) How extensive is the shifting of the clams over $\frac{1}{2}$ an inch in length?

(9) Is this shifting voluntary, or unavoidable?

Many difficult questions arise as to the food of the clams in the larval stages, as well as for the adults. The enemies of the clams during their successive periods of development call for careful study.

Observations and Experiments at Plymouth during 1906.

This past year we have conducted a number of experiments in Plymouth harbor upon the soft-shelled clam (*Mya arenaria*), with an ultimate view to increasing the production from that extensive area. In years gone by the flats furnished occupation for many diggers; but at present from Plymouth flats, even during the summer months of greatest demand, scarcely two barrels daily are dug.

In this report we describe, first, the present state of clam life throughout the harbor (1) from a careful observation of clams still surviving along the shore, as well as upon the flats; (2) from the results of numerous artificial beds made in a number of localities; (3) and from a careful study of the 1906 set of young clams on the flats of the harbor. Secondly, we give our present opinions upon the continued depletion of clams, with a few brief suggestions as to dealing with the problem in clam culture.

The Localities in which Clams are found to-day.—I. A few clams still grow along the shores: (1) in the gravel upon the south side of Clark's Island clams have always thrived; (2) from Plymouth beach a few are obtained; (3) the several grants to property holders along the shore contain thickly seeded but slowest-growing clams. One man, who owns a grant, remarked to me: "I thought, when I had seeded my grant and had adequately protected it, I should have an abundance of clams, but they don't grow. It will take four years to raise a clam fit for bait." His statement is correct. Over these shore flats, exposed many hours, the current is slight, in fact, over much of this area there is merely a most gentle inspreding of the tide and an equally gentle ebb. There are, however, a few relatively small shore areas, viz., on projecting points, where the current is stronger and the growth proportionately greater. Yet the entire extent of the shore flats from the Cordage Company's plant to Eel River is small as compared with the possible clam area of the now barren flats in the center of the harbor. The shore flats are, as a rule, rather high up and relatively narrow; for wherever the gravel along the shore gives way to the mud flats, here the clam set almost invariably ends. The muddy areas along the shore, as well as upon the flats (except where new soil has been formed upon them), which in well-seeded harbors are filled with clams, here are barren. (4) To the south of Beach wharf there has been a fair production from the "Dump," but this now is on the wane.

II. Upon the extensive flats of the harbor scarcely any clams are to be found. Here and there upon several of the central flats an experienced clammer may dig by tedious effort ten to a dozen large clams, but they are very scarce. In but few areas upon these central flats, and these of small extent, are clams to be found in any number. (1) The first is upon the top of Wind Flat, amongst the scattering mussels, where are a few clams of 1904 or 1905, with a greater set of 1906. The soil is very dark, in some cases soft and muddy. Here their growth is relatively slow. Near at hand are areas lower down, more sandy with a better current, but without a clam (similar areas in Ipswich are more productive). (2) Upon the west side of Wind Flat, where the scattering mussels have raised the level of the flat, a small set is found. (3) Upon the high southeastern portion of White Flat, as (4) upon a similar area of Egobert's, there are a few clams of all ages burrowed deep in the shifting sand. But leave this high shifting portion of the flat and examine lower down, amongst the areas where are scattering worms or eel grass or mussels and one finds no clams. (5) Upon a small portion of Grey's Flat in Kingston, in the neighborhood of scattering mussels, a numerous set has grown for many years. Upon this area one or two men make a regular practice of digging; but the clams are either numerous and of small size, fit only for steaming, or else large but few in number. This area is a

lone survivor of former abundance. (6) Even upon the highest parts of the flats, south of the Oyster Grant, there are no clams. There may be other limited areas within Plymouth harbor on which are scattering clams, but these are few and far between.

Note that all these spots where clams are found are (1) the very tops of the flats; (2) where there is shifting; (3) where new soil has been formed; (4) or else they are gravel beds or thatch banks along the shore. Very rarely does one find clams upon the low flats or upon the lower parts of the higher flats, and these are the great areas that should be so productive; these areas are barren. Such, from careful observation, are the conditions obtaining at present in Plymouth harbor.

The Results from the Planting of Clams throughout the Harbor.— During 1906 we have conducted at Plymouth a long series of experiments in clam culture. We have planted about 150 clam beds, in most of which the clams have died.

I. Early in May we made five beds on the Oyster Grant, Beach Wharf Flat, White, Grey's and Egobert's flats. We planted clams of small size, — probably too small for these areas. They averaged 1,200 to 1,500 per quart. Before the end of June not a live clam and very few shells were left in these beds.

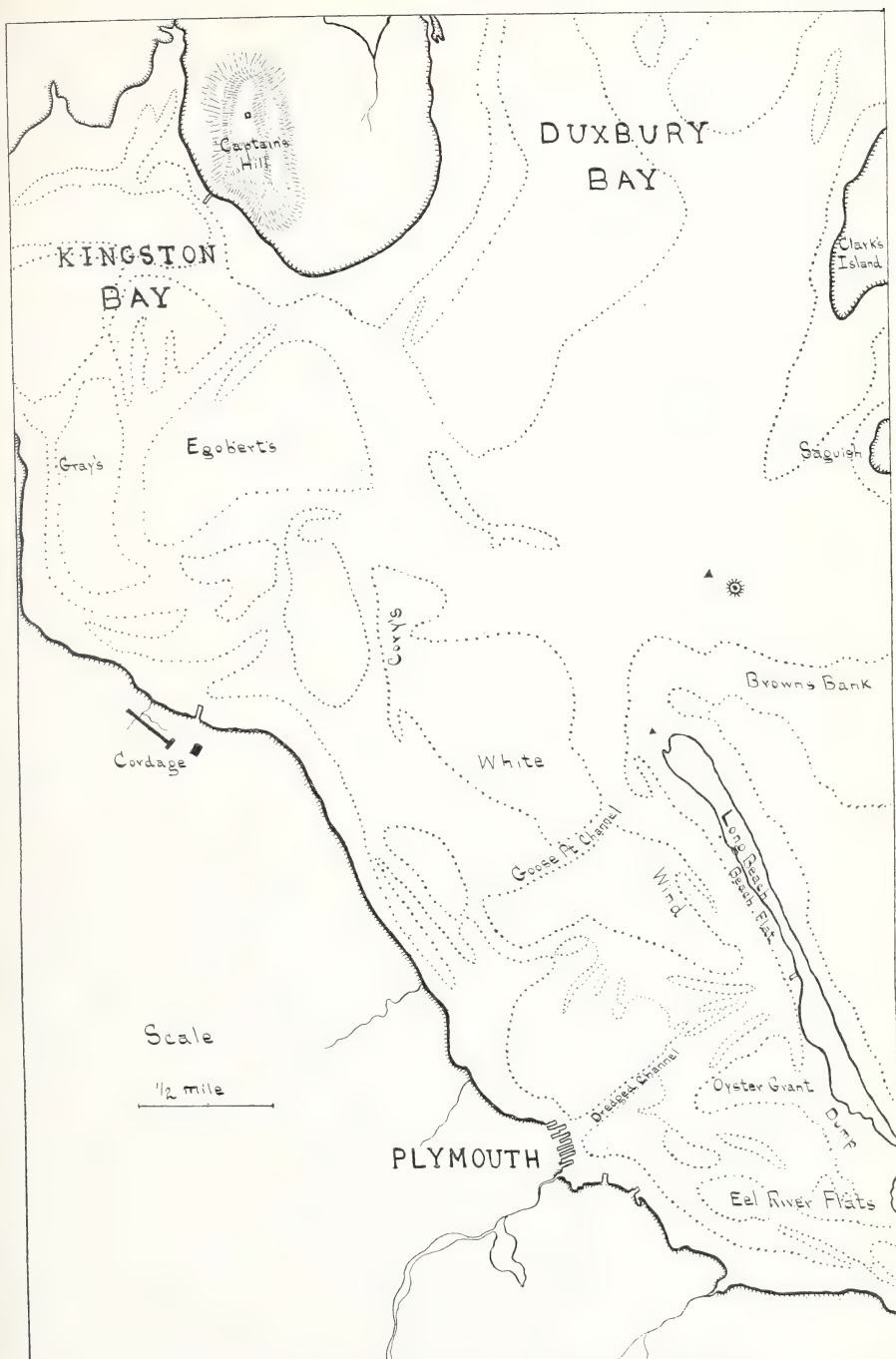
II. The first week in July I replanted the five beds with larger clams of several sizes, dug partly from the shore grants and partly from Grey's Flat. The first of August we found that the beds planted upon White's and Egobert's flats, where the sand was high and rather shifting, contained both shore and flat clams in thriving condition. There were no live clams in the other beds. These latter were upon old soil that shifted very little.

III. At once we planted about 90 more clam beds, putting from 30 to 50 clams of various sizes in a straight line between two posts. These beds were approximately as follows:—

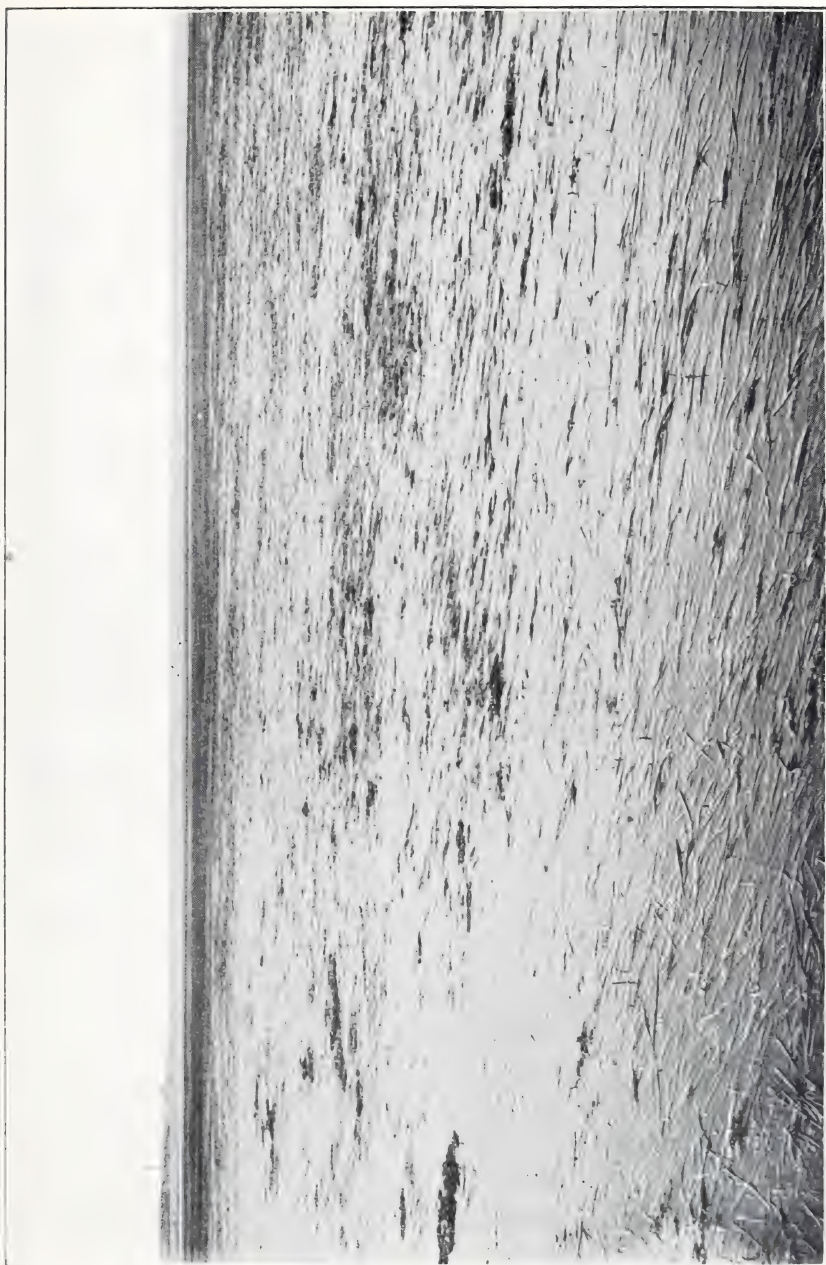
1. Eel River outlet, south of the Oyster Grant,	15 beds.
2. Oyster grant,	6 beds.
3. Wind Flat,	12 beds.
4. White Flat,	15 beds.
5. Cory's Flat,	10 beds.
6. Grey's Flat,	15 beds.
7. Egobert's Flat,	15 beds.

About October 20 I carefully examined all the beds, and found as follows:—

1. Eel River outlet: all dead; some bored; some shells; many missing.
2. Oyster Grant: all dead.
3. Wind Flat: five beds, planted up among scattering eel grass and mussels, contained some live clams. These surviving beds had been planted near the natural set mentioned before. Those made elsewhere on the flat were failures.



A rough outline of the chief Plymouth flats at present practically barren of clams. During 1906 the commission planted a number of experimental clam beds upon the flats named in the sketch. But few of these beds contained live clams Dec. 1, 1906.



Plymouth harbor, Mass. (Oct. 24, 1906.) Wind Flat to the northwest. A vast eel-grass area, that some day, not far distant, may raise annually thousands of bushels of clams.



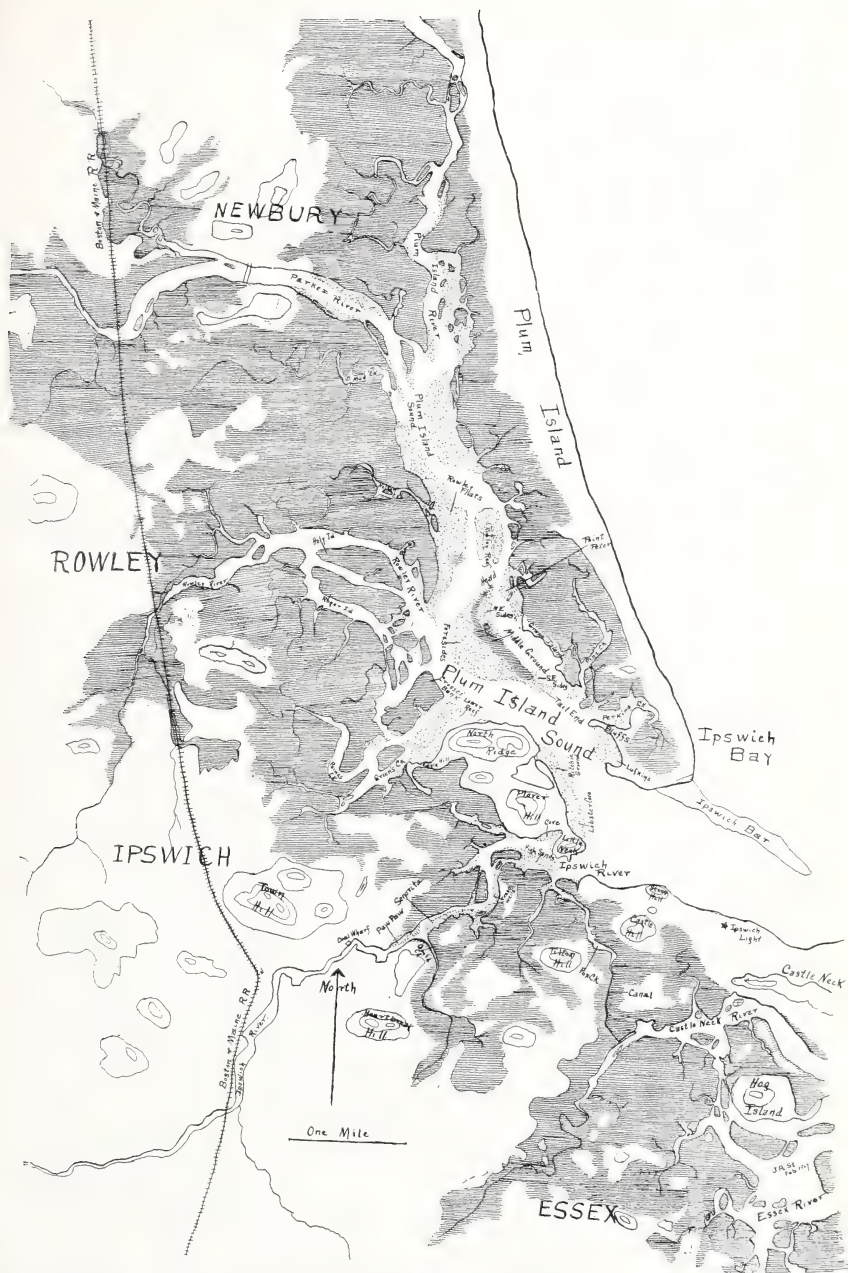
Wind Flat, Plymouth harbor, Mass. (Oct. 24, 1906.) A flat practically barren of clams. The foreground relatively smooth, with some dead eel grass over it. Farther distant, a portion rippled by more rapid currents. Back of this a long, narrow, black mussel (*Mytilus*) bed. This flat, under proper methods of cultivation, should be exceedingly productive of clams.



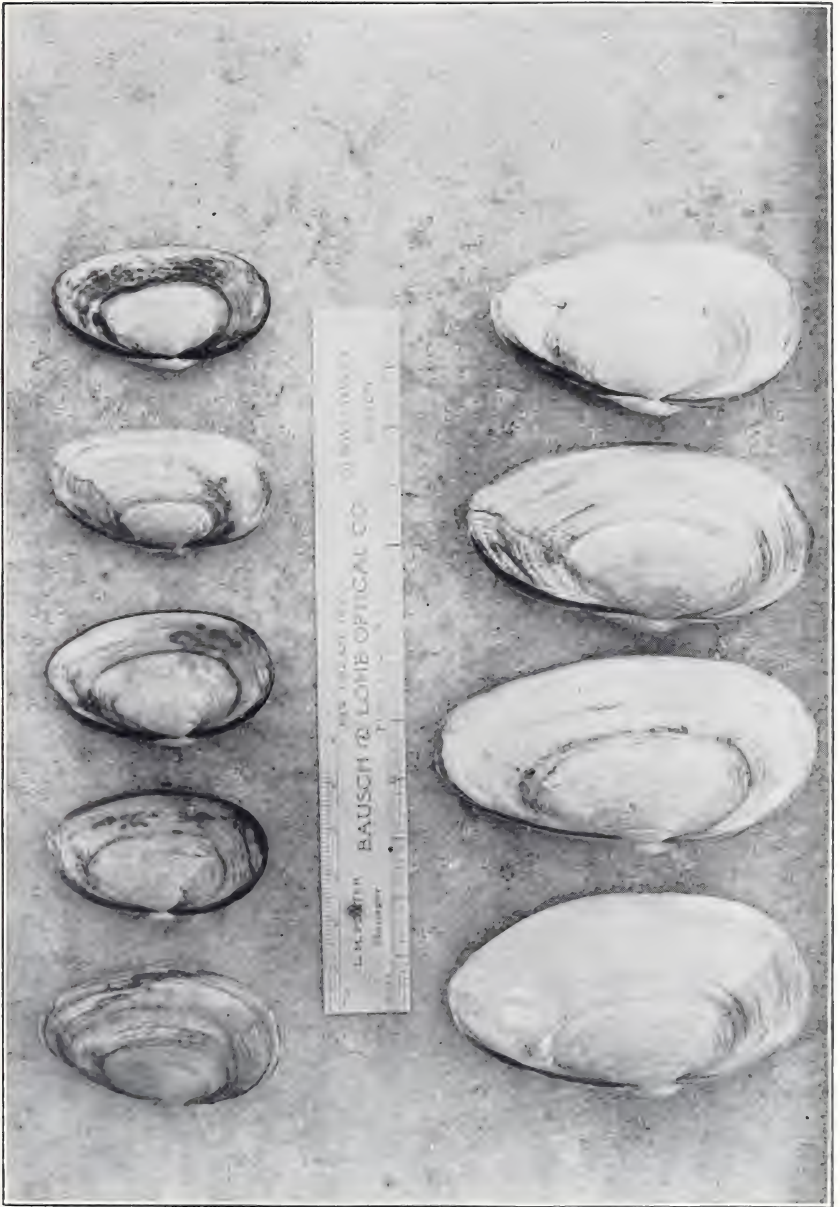
The highest portion of Wind Flat, Plymouth harbor, Captain's Hill in the background. (Oct. 24, 1906.) Upon the "harder" soil between the mussel growth a scattering clam set of 1904, 1905 and 1906. This should be productive; but, like practically all the flats of Plymouth harbor to-day, it lies barren and unproductive.



Wind Flat, Plymouth harbor. (Oct. 24, 1906.) A barren, smooth area. Digging over a portion of the flat, in preparation for an experimental clam bed.



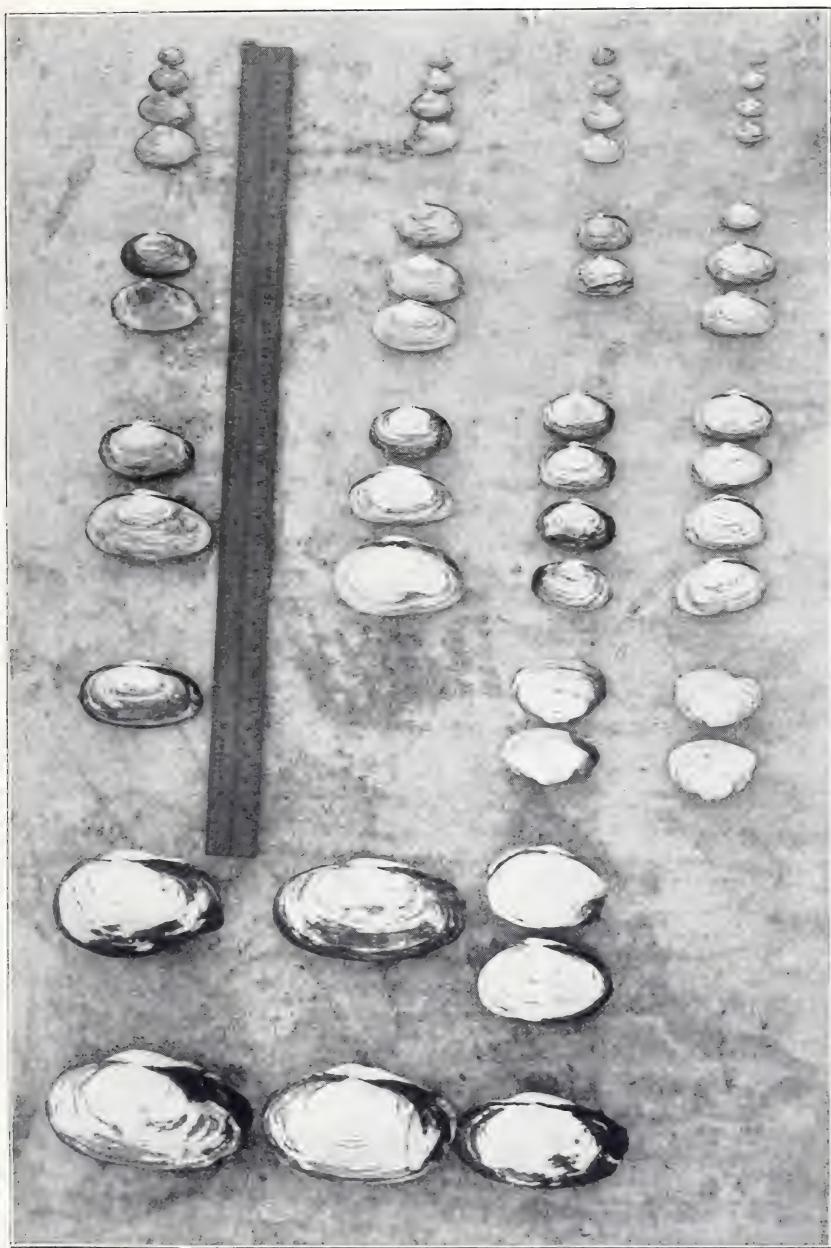
Plum Island Sound area, the chief clam flats roughly stippled. Even here, upon the most productive clam area in Massachusetts, the abundance of clams is far less than the maximum. In the Sound no sewage or manufacturing waste enter as a factor in clam destruction.



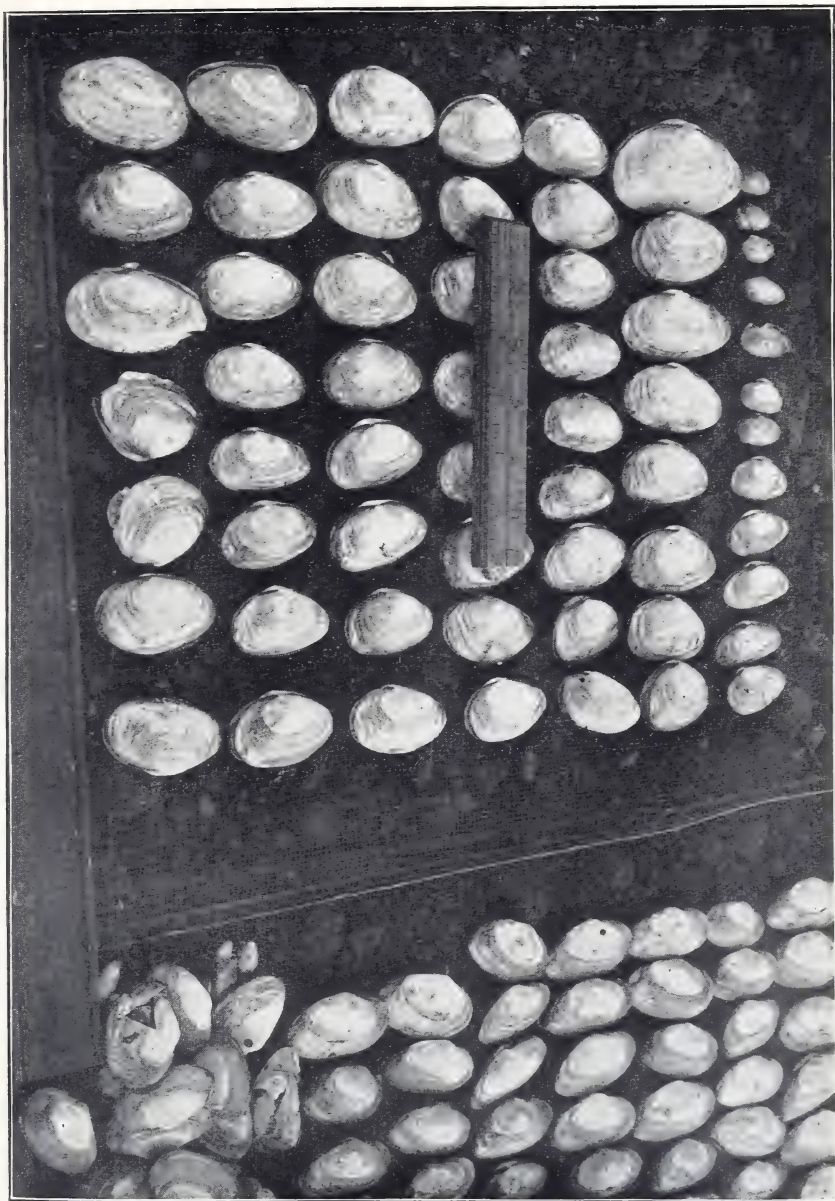
From Plum Island Sound. (Sept. 1, 1906.) A rapid two-year growth compared with a slow two-year growth. There is a surprising difference in the growth rates of two flats which may even be close together. The rate of growth on the one may be three times greater than the rate upon the other; hence the absurdity of working out growth rate tables unless one takes into account the height of a flat above low tide, the texture of its soil, the abundance of its food supply, and, most important of all, the force of the currents over it. Excellent clam growth is obtained only from a combination of several favorable conditions.



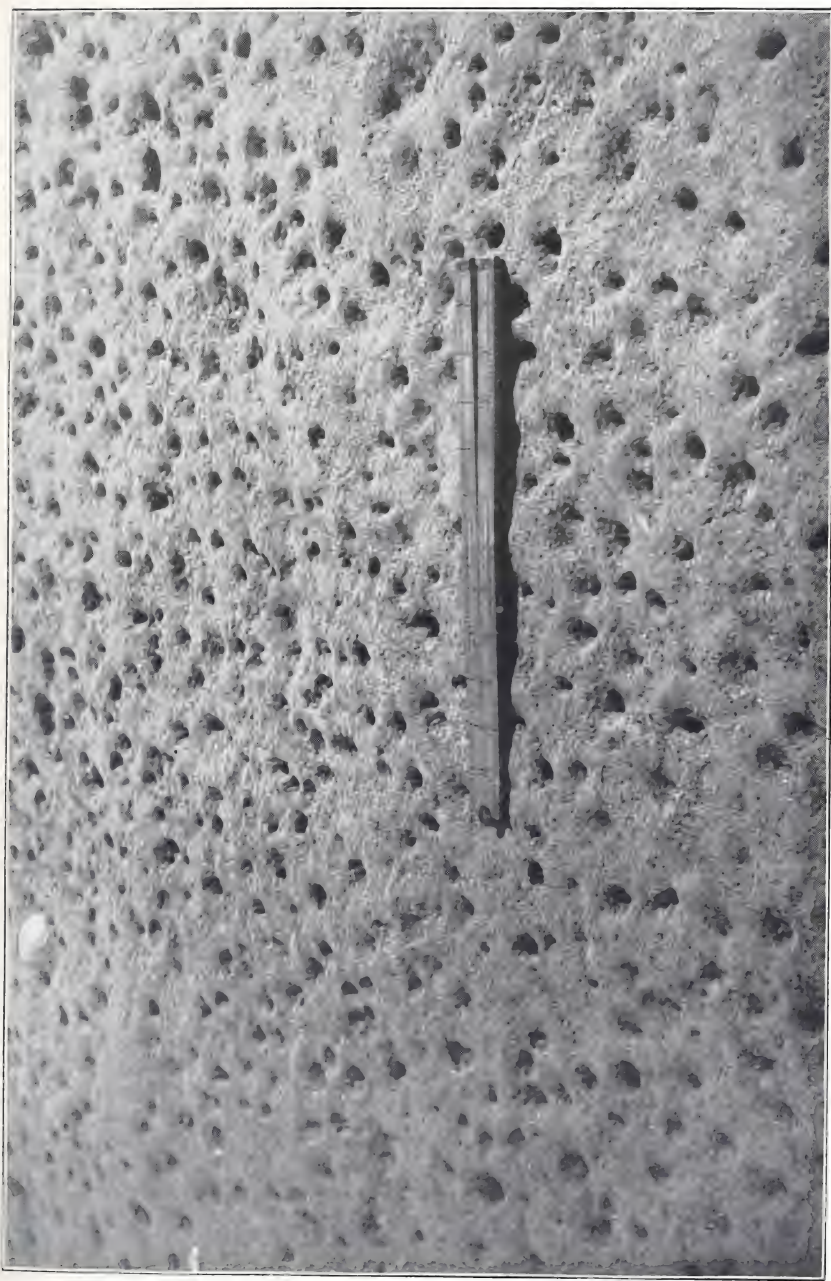
From a thickly set area just to the west of the High Sands, Ipswich River.
(Aug. 25, 1906.) One square foot of the flat, carefully dug, produced 176
clams. The smallest are of a late 1905 set, the great majority of a 1904 set.



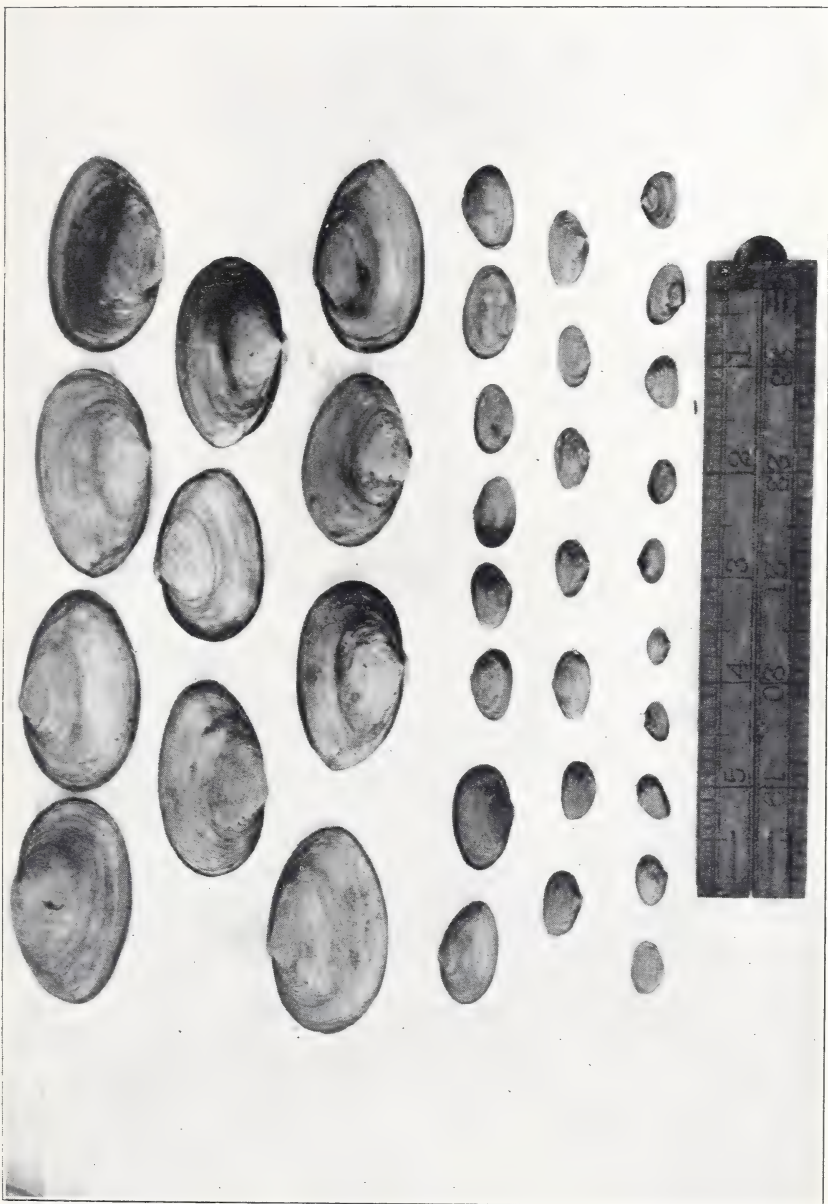
From a gravel bank on the east side of Fox Creek, at its junction with Ipswich River. (August, 1906.) About one-third natural size. The row to the left of the ruler was from a square foot of soil located about two hours above low-tide mark. The next rows were taken from areas of equal extent, successively higher up the gravel bank. The clams are fewer and of smaller size the farther they are from the low-tide mark.



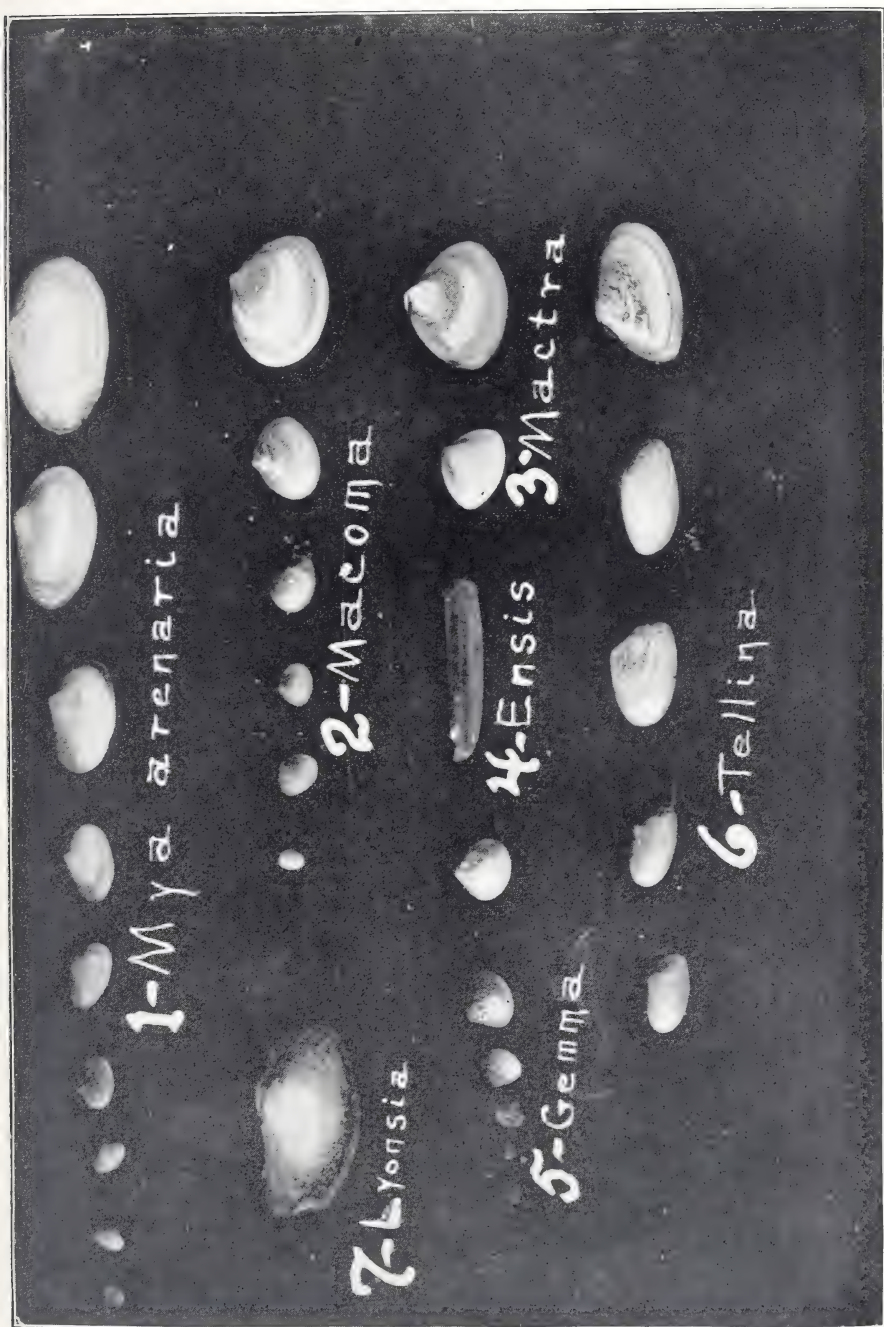
From the mouth of Ipswich River, eastern edge of High Sands, where shifting occurs to some extent. (Aug. 25, 1906.) One square foot contained 62 clams, somewhat larger in size (due to better current), but fewer in number (due to unfavorable conditions for the young set) than upon the less shifting areas of the flat.



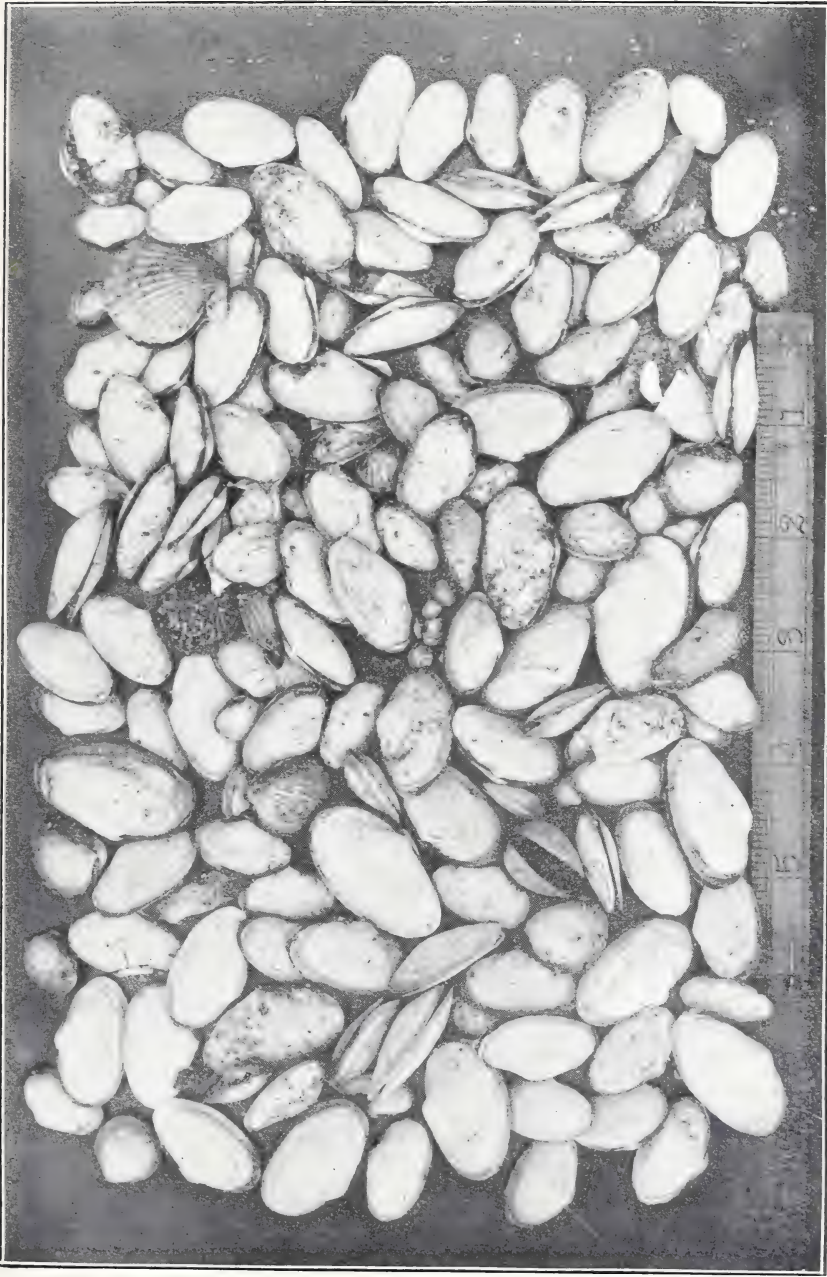
Clam "holes," southwest of the High Sands, Ipswich River. (Aug. 25, 1906.) A very heavy set. This set averages 200 per square foot. Frequently two, even three, clams share the same "hole." The clams are arranged in tiers, according to age and size. They are below the surface, and cannot be seen in the photograph.



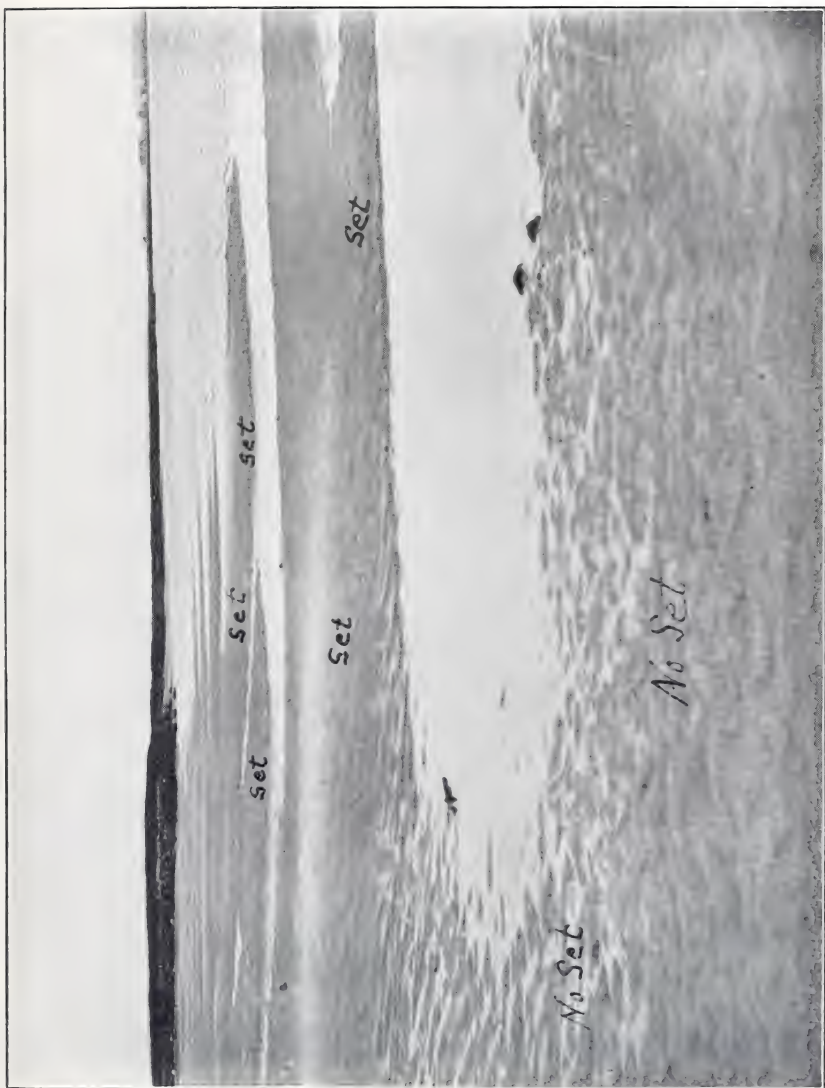
From Plum Island Sound. (About Sept. 1, 1906.) About one-half natural size. Clams of approximately the same age; the larger grown in a rapid current near low tide, upon "Foresides;" the smaller, in a slow current upon a "high flat," Point Peter.



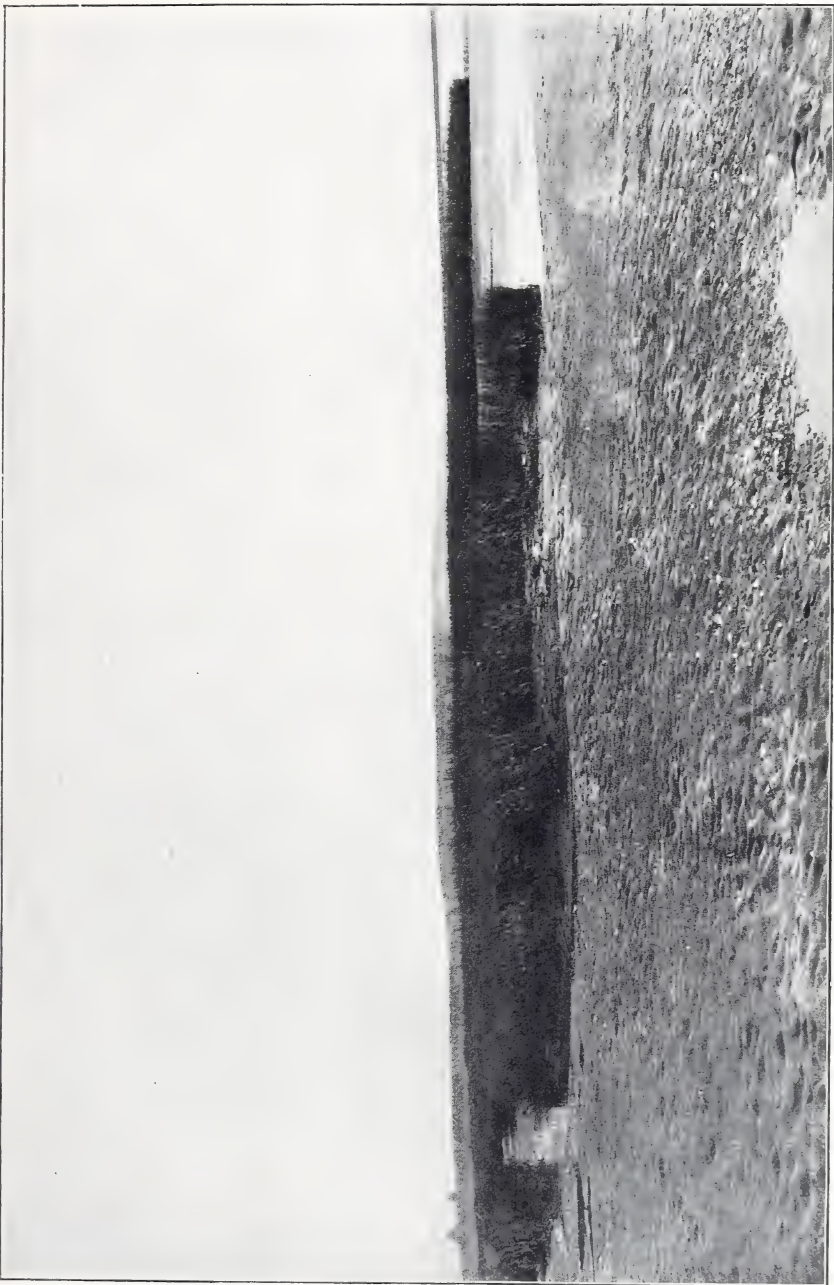
Largely from "Foresides," Plum Island Sound. (Sept. 21, 1906.) One and three-fifths natural size. The young of several species, 1. *Mya arenaria*, the soft-shelled clam. 2. *Macoma baltica*. 3. *Mactra solidissima*, the sea clam. 4. *Ensis directris* or *Solen ensis*, the razor clam. 5. *Gemma gemma*, the tiny blue "qualang." 6. *Tellina tenera*. 7. *L Lyonsia*. *Nucula* and *Gemma* are similar in size and shape, but vary in color of shell and internal structure. *Nucula* is as a rule found in deeper water.



From Powder Hole, Monomoy, Chatham, Mass.; from spat box No. 8, area about two square feet. (Nov. 19, 1906.) One-half natural size. These young shellfish settled in this box shortly after August 1, while yet free-swimming larvae. Note the young quahogs in the centre of the photograph and compare their relatively slow rate of growth with that of the scallops and clams.



View, looking north, along the east side of the Middle Ground of Plum Island Sound. (Sept. 7, 1906.) The free-swimming clam larvae have been settling upon this flat in increasing numbers for the past fortnight. Upon the southerly slope of these sand reaches extending into the Sound there occurs a set of young clams in some spots averaging 1,000 per square foot. They vary in length from 1 mm. to 6 mm., but all are firmly attached to the sand by their strong byssal threads. This attachment prevents the successful collection of clams as young as these for seedling barren areas.



Plum Island Sound. (Sept. 5, 1906.) A portion of Point Peter, where the set is of very slow growth. A high, sandy flat, washed by a relatively slow current.



"Foresides," Plum Island Sound. (Sept. 29, 1906.) Southerly rippled portion of the flat. Large, rapidly growing clams thrive here, but there is very little 1906 set. The current is swift, causing too extensive a shifting of the sand for a favorable set. Tom Roberts, an expert Ipswich clammer, seen in the foreground.



“Foresides,” Plum Island Sound, looking northward toward the mouth of Rowley River. (Sept. 29, 1906.) A relatively level, fine soil. Here mature clams abound, also here is a heavy 1906 set. Recent digging, as well as the scouring of the strong tides, causes the irregularities in the flats.



From Powder Hole Flats, Chatham, Mass. (Nov. 20, 1906.) All natural size. The two largest clams are late 1905 set; the rest are 1906 set. Here the 1906 set is very small, but during 1905 an unusually heavy set occurred; this illustrates the wide annual variation in the abundance of the clam set in any one locality.

From the Middle Ground, Plum Island Sound. (Oct. 15, 1906.) The uppermost group of small clams shows the natural size of the young set on "Fore-sides." Here the set is usually later than on "Southeast Sides." Immediately below and to the right are four clams about 15 mm. in length, the largest which could be found on "Southeast Sides." Here about September 10 the set in some spots was 1,000 clams per square foot. By October 15 the individuals of this young set varied from 1 mm. to 15 mm. long. The two larger clams were notched on Sept. 21, 1906, and immediately planted upon "Fore-sides." They were dug again on October 15. The figures show the growth made between these dates, an interval of twenty-four days. The largest clam shown on this plate grew from 41 mm. long May 1 to 99 mm. (about 4 inches) in length by September 20, under most favorable conditions. The photograph at the bottom of the plate shows the average rate of growth of clams on the Powder Hole Flat, Monomoy Point, Chatham, Mass.: July 20, 1905, length 27 mm.; Nov. 15, 1905, length 38 mm.; Aug. 5, 1906, length 54 mm.; Nov. 20, 1906, length 66 mm.; 25 mm. = approximately 1 inch.





From Plum Island Sound "Foresides." (Sept. 5, 1906.) Two-thirds natural size. In the centre are small 1906 clams; next are four 1905 set, greatly retarded in their growth; then come two clams probably of 1904 set, also showing a slow growth. The large clam at top of the photograph is probably of 1904 set, showing a rapid growth. The largest clam, at bottom of photograph, may be four years old.



From Ipswich, Plum Island Sound. (September, 1906.) An excellent "Fore-sides" clam, natural size; probably three years old.

4. White's Flat: all dead except in one bed upon the highest part, where the sand shifts.

5. Cory's Flat: all dead, though planted under many diverse conditions and far apart; but no beds on this flat were made upon shifting areas, none upon new soil.

6. Grey's Flat: all dead. No beds were made under the conditions of the natural set growing there, as was done upon Wind Flat.

7. Egobert's Flat: all dead but in one bed planted upon soil similar to the lone survivor of White's Flat.

Thus, of nearly 90 beds, but seven contained living clams at the end of ten weeks.

Some have argued that the cause of the death of the clams in most of these beds planted during August was the unusually warm weather at this time. This is not the reason, for: (1) During the same month we planted clams upon the North Shore as well as along Cape Cod, that grew well. (2) From earlier reports of clam transplanting, summer beds have been a success. (3) The clams that we dug for transplanting were healthy, and they showed no fatigue when planted upon the flats. Those beds containing, at the end of ten weeks, living clams, were in places unfavorable for the best growth during the hot months, — well up above low tide, and exposed for many hours daily to the direct rays of the sun. Those clams planted in the apparently favorable areas died without exception.

IV. After examining these beds throughout the harbor, I made further experiments: (1) Upon a barren area of Wind Flat, where there were few worms, no mussels and no eel grass, a spot about 20 feet square was forked over, and after several days planted to both shore and flat clams of several sizes. The first of December no live clams were found in the bed; a few had been bored, some were dead, but a large part were missing. This spot shifts but little; the small areas upon White's and Egobert's flats, where clams now grow, shift much more. The current action over this Wind Flat bed is most favorable, and has not caused the destruction of the clams. (2) At the same time I planted a small bed, turned over beforehand, upon an area of Wind Flat, near the former bed where scattering eel grass grows. Here, many of the planted clams lived. (3) A large bed was carefully dug over and planted among the scattering mussels of Wind Flat, where there is a small natural set. Here, December 1, the clams were thriving; none bored, none dead, none missing.

These experiments upon Wind Flat merely confirmed our former conclusions, as did beds planted at this time upon White's and Egobert's flats and upon the Oyster Grant.

Our experiments as a whole have confirmed our observations in regard to the areas that at present are in condition for the growth of clams. They point to the fact that all those areas fit for clam growth are set naturally with clams at the present time. Upon these spots

where the clams naturally settle are clams of many ages,—sets of 1903, 1904, 1905 and 1906. These are areas of (1) new soil formed by mussel growth or spreading eel grass or harbor dredging; of (2) shifting sand, where the current is not excessive; (3) and of gravel flats, through which the water freely percolates. In Plymouth harbor these spots alone contain living clams: elsewhere, clams die. Here are the facts, from which to draw conclusions.

The 1906 Set of Clams: the Abundance of Free-swimming Clam Larvæ in Plymouth Harbor.—The argument that there is “no spawn in the harbor,” meaning that too few old clams are left to furnish set for the flats, is of no weight. The spawning season for the clam at Plymouth is at its height in the latter part of July and the first of August. From our towings through the water with a fine silk net we procured great numbers of clam larvæ; these towings were taken from many parts of the harbor. There is an abundance of swimming clam larvæ.

The source of this abundance is in large measure the clam grants along Plymouth shore. It is most unfortunate for the outlook of clam increase on Plymouth flats that several of the large private grants have recently expired. They are being dug out rapidly. Little spawn from these areas can be expected another season, unless digging is stopped, either by action of the selectmen or by a renewal of the grants. One thing is certain; every locality in Plymouth harbor upon which clams can by any means be made to grow and multiply should be protected carefully. Reckless digging of but a bushel or two of clams daily during these years of exhaustion works more harm to the clam industry than the digging of hundreds of bushels in times of abundance.

The number of clam larvæ that pass this free-swimming stage is at present amply sufficient to repopulate the barren areas. While at Plymouth during the latter part of October I paid careful attention to the summer's set of young clams upon the several flats.

(1) Upon Grey's Flat, where the clams are usually found, the set was thick,—in some spots very thick. Upon a few small spots of the flat where I had previously found no natural set, and where our beds of August had failed, there was a small 1906 set in thriving condition. Here we have young clams, less than $\frac{1}{2}$ inch long, thriving in numbers directly over the spot where older clams, more deeply burrowed, died.

(2) There was no set upon Egobert's Flat. From my study at Ipswich I conclude that the Egobert area upon which the older clams thrive is too shifting for the young larvæ to settle upon in any number. Elsewhere upon the flat upon the favorable setting areas (so they would be regarded upon the north shore) there were no young clams, or older either, for that matter.

(3) I could discover no set upon Cory's Flat or upon White's Flat, where the conditions are similar to those upon Egobert's.

(4) A fair set came upon Wind Flat, but only upon the areas previously occupied by clams.

(5) There were none upon the Oyster Grant or upon the flats to the south.

(6) I found a very thick set along Plymouth beach, south of Beach wharf, but not low down, only high up in the gravel and thatch.

(7) A thick set has come south of the Atwood lumber yard; but here only in the gravel, not in the mud farther out from the shore. I am told that elsewhere along the Plymouth shore a good set has come. However, this set of 1906 in Plymouth harbor I find upon spots high up, well above low tide. If so found at Ipswich, I should say the clams were on an unfavorable area. In Plum Island Sound, as I hope to show later by photographs, maps, drawings, etc., the thickest set occurs upon those portions of the flats similar to those which at Plymouth grow neither large nor small clams, upon which our experimental plantings without exception have failed utterly.

The Important Point. — A question now clearly confronts us. Why is it that upon the natural and original clam areas of each flat neither the young set comes nor the mature clams grow? There appear to be many forces at work upon Plymouth flats harmful to clam life. Let us mention possible harmful factors: (1) excessive digging; (2) starvation of the clams through destruction of the diatoms, their staple food; (3) contaminated water; (4) *Lunatia* (cockle) boring; (5) ice action; (6) encroaching eel grass; (7) encroaching mussels; (8) a lack of digging.

(1) I have no doubt that the continued depletion of the Plymouth flats is due in some part to over-digging. It may be *a* cause, but it is by no means *the* sole cause of depletion. Even this past summer, with clams so few upon the Plymouth flats, a number of bushels were dug daily. Wherever a few small clams are found growing along the shore or upon the top of some flat, the clambers soon have them in their baskets, and the possible "brood ground" is destroyed. The localities now growing clams should be jealously guarded; their spawn is needed to set further areas. We can hope for no increase of clamming at Plymouth unless we protect the places upon which comes the annual set, — in some localities more numerous each successive year. Except from some grants, for purposes of thinning out the set where too numerous, it would be far better for the next two or three years that no clams be taken from the harbor.

(2) The argument as to the starvation of the clams through lack of nourishment is of trifling weight. If clams thrive in great numbers in high, long-exposed spots, and in localities where the current is very slight, there surely must be an excellent food supply, or else all would perish. If starvation caused the death of clams at Plymouth, we should find them living now, if living at all, only in the most fa-

avorable localities, similar to the best Ipswich areas; instead, we find young and old clams only in localities that seem comparatively unfavorable to their best and most rapid development. Further observation is necessary, especially by means of the Sedgwick-Rafter method of filtration and counting of diatoms, etc., which we have used along the North Shore.

(3) There is little evidence to support the statement that contaminated water is the cause of the destruction.

(a) If the water be impure, how is it that the mussels (*Mytilus edulis*) thrive over areas so extensive? And the mussels are ever spreading. The food of the mussels is practically identical with that of the clams. They live mainly upon diatoms, very minute, vegetable organisms. The mussel thrives upon a large part of the Plymouth flats. The clam grows but sparsely, and only along the shore and upon the tops of certain flats, where there is either shifting of the sand or else newly prepared soil. This year a very heavy set, forming a veritable mussel-mat upon the surface of the flat, has occupied several acres of what should be favorable clam ground upon both White's and Egobert's flats. Unless some means are at once taken to remove these young mussels, that grow so rapidly, a large and valuable area will become worthless for clam production for a number of years, at least. This is no unimportant matter.

Over extensive areas where no clams are found the razor clam (*Ensis directus* or *Solen ensis*) abounds, and its food also is the same as that of the clam. Neither the mussel nor the razor live burrowed deeply in one spot in the flat, as does the clam. The razor is constantly in motion through the soil, while the mussel thrives upon the surface. I might cite further forms that live where clams die, and whose food is identical with the food of the clam.

(b) Why does the young set thrive in places where the older clams die? The cause of this destruction lies, not *upon* the surface, but *below*.

(c) Last November several specimens of water from Plymouth streams, as well as from certain flats, were carefully analyzed. There appeared no trace of copper or iron, which might act as an algicide in the harbor water, while the amount from any of the entering streams was very slight. At certain periods, however, the streams *may* carry down waste matter containing larger per cents. of copper compounds. Waste products of petroleum also may here do injury.

(d) Plymouth harbor at low tide contains as little water as any harbor of its size in the State, while at high tide it is a full sea. This drainage so complete twice each day is an all-powerful factor in supplying the shell-life with the purest of sea water, and in removing whatever impurities are brought down by streams and sewers. The chief cause of this destruction, in my opinion, does not lie in a contaminated water supply.

(4) The "cockles" or "borers" (*Lunatia heros* and *L. duplicata* [Polynices, Natica]) are great enemies to the clams, wherever found. By means of its lingual ribbon or file-like tongue, the cockle rapidly bores a countersunk hole through one valve of the clam, and then sucks out the soft parts of its prey. At Newburyport and Ipswich, where clams occupy practically all the available flats, cockles are few in number, and the clambers, many of them, are ignorant of their destructive powers. Though at Plymouth extremely abundant in days gone by, the cockles, especially the larger ones, are at present far less numerous. Men who make a business of "cockling" declare they are unable to earn as much to-day as they did some years ago, in spite of the fact that the price per bucket has advanced 25 per cent. and more. In fact, as this genus of mollusks is a source of excellent income for many men, should not their decreasing abundance be investigated? Otherwise, cockles may become as scarce in Plymouth harbor as clams are to-day. Soon nothing will remain but eel grass and razor fish.

The mussels living upon the surface of the flats are easier of access than are the burrowed clams. Cockles of all sizes tend to congregate about and beneath the mussel beds, which suffer extensively from the "borers."

Certain men in Plymouth have told me that many years ago the cockles were relatively few in number, but that they rapidly increased in abundance at about the time of the clams' most rapid decrease. It may be that to the cockle, more than to any other cause, is due the first depletion of the clam areas.

But some other agency (or agencies) is the cause of this *continued* depletion. It is only upon areas where clams are in scattering numbers that the cockles do the greatest injury. Where the clams are numerous, the cockles that congregate about them are easily and with avidity gathered for bait by the fishermen. In some small clam beds I have found most of the clams with bored shells, but in very many beds under diverse conditions I have found scarcely a shell bored; yet all the clams that were planted in these beds had died. Why?

Though cockles may have destroyed the former thriving clam areas, though they do some injury at present, especially in isolated beds, there is some other agency or combination of agencies that prevents the growth of clams in Plymouth harbor to-day.

There is a current belief in certain harbors of the coast that the "periwinkle" (*Littorina*) and the "black winkle" or "little sea-snail" (*Nassa*) destroy young clams. This past year we have conducted a series of box experiments with *Littorina*, *Nassa*, and clams of various sizes. We have found no evidence of such destruction. As soon, however, as a clam shell is broken, many *Littorina* and *Nassa* flock to it and devour the soft contents. It is our belief that these gastropods do no harm whatsoever to the healthy clams of any size or age.

(5) Ice may cause slight injury, but it is very little. Only upon the tops of the flats do the clams thrive, yet here ice action is always strongest. If ice to any extent destroyed the clams, one would expect to find clams growing only upon the low and better-protected areas; but this is not the case.

(6) Vast stretches of good clam flats are now occupied by eel grass. As long as this retains possession of these areas we can expect no clams to thrive upon them. Several reliable men, living both in Newburyport and in Ipswich, have described to me the increased area of clam flats where formerly grew puny and contorted clams, when, during some years since clamming declined, the diggers were compelled to turn to these flats, thereby killing out the eel grass. Soon a set larger than before came in, and these clams grew more quickly and to a greater size. In fact, the flats, once covered by abundant eel grass, now produce excellent clams, and are valuable acquisitions to the clamming areas of the respective towns. I have been told by reliable Plymouth men that eel grass has spread over extensive areas formerly productive of good clams. Although much of the Plymouth eel-grass area has a very low, watery soil, yet I believe that portions of many flats, now eel-grass-covered, can be reclaimed with profit. However, there are areas so numerous and extensive, covered by neither eel grass nor mussels, and probably more easy to render fit for clam culture, that the eel-grass question of Plymouth need not immediately concern us.

(7) The area occupied by mussels (the action of these has been described) changes somewhat, but as a rule, when a bed becomes firmly established upon a flat, many years are needed to render the soil good for clamming, and the mussel area is becoming larger each succeeding year. Both mussels and eel grass are detrimental to clam life, in that they occupy valuable flats that should be set by clams alone. They may, however, perform a necessary service for successful clam growth in preparing the soil and in rendering it suitable for clam culture.

Neither of these last two factors has caused the depletion of the flats; they simply have usurped the rightful area of the clam, either to retain it permanently, when they must be accounted enemies, or else to hand over the flats once more fit for occupation by the ostracized clam, in which case they directly become benefactors.

(8) Thus far I have mentioned a number of active factors that may be harmful to clam growth, but which in reality do but little injury. There is another factor that operates passively, namely, a *lack of digging* upon the flats. Many clammers on Plum Island Sound, when asked as to the value of frequent digging of the clam flats, unanimously declare in favor of it. They reason much as follows: "You see practically all our flats are well seeded to clams, but they are constantly being dug; in fact, many flats are over-dug. This

constant digging keeps the soil in a wholesome, healthy condition." A few years ago a flat near Eagle Hill, Ipswich, was dug out during severe freezing weather. Clams have not grown here, nor has the flat been broken up since. Upon this flat we planted a bed last summer. The clams in this bed died, but worms, *Solenomya*, etc., live here in abundance. The conditions here are somewhat similar to those at Plymouth. Neither the Eagle Hill flat nor the majority of the Plymouth areas will grow clams until either new soil is made, or the flat is thoroughly broken up.

I do not maintain that lack of digging has caused the depletion of the flats; that is due mainly to other causes, such as excessive digging, the work of the "borers," etc. But I do maintain that the clams where seeded should be "cultivated," and frequently cultivated, especially if set in soil comprised largely of clay or mud. Upon gravel and stony areas the water percolates more freely into the flats; upon areas of shifting sand there is not this need; but upon a firm, unchanging flat, a turning of the soil is beneficial to the growth of the clam, and essential in many cases to its very life. The Plymouth flats have been so long undisturbed that they need an artificial shifting of the soil, similar to that caused by storms upon the high, sandy areas, where to-day some clams thrive.

This coming spring we wish to carry on a comparative series of experiments: one at Plymouth, or Kingston; another upon certain barren areas of Plum Island Sound, especially those lying within the limits of the town of Rowley; and a third series upon a good Ipswich flat. We desire to find out the cheapest and most speedy methods of working the soil for profitable clam culture. There may easily be an excess of digging, but a lack of work upon the soil of a flat is equally disastrous. This passive factor, viz: the lack of digging, is the greatest, possibly the only present existing hindrance to thriving clam growth in Plymouth harbor.

A Rotation of Life upon the Tidal Flats.—The extensive clam flats of Ipswich for many years have been dug with profit, yet to-day the supply holds good. It seems as if clams are the only form of life upon the flats, so completely have they taken possession. Other shell-fish find scanty representation. Muddy soil and sandy soil, rippled and smooth, is mainly clam set. A few *Macoma*, *Tellina*, sea clams and razors, with numerous *Gemma* and some mussel sets, are found among the clams, but these are as nothing when compared with the clam set.

Now, at Plymouth, on certain portions of the Essex flats, and in many other harbors of the State, the flat life is utterly different. The clams have been dug out, or at least, for some cause, they are gone. There also are practically no *Gemma*, *Tellina*, *Macoma* or *Macra*. In their places we often find razor fish; frequently the fancifully fringe-edged *Solenomya*; the rough-skinned *Holothurian*, *Synapta*

girardii; and, most abundant, worms of many genera,—the long band worm (*Meekelia*), the “blood” and “clam” worms (*Glycera*, *Nereis*, *et al.*), the tube worms (*Clymenella*, *et al.*). Especially numerous are these last,—red, jointed, with a scalloped cup terminating the posterior segment. Upon turning over the soil, frequently hundreds of these cemented sand tubes are found in one square foot. So close together do these worms live that they monopolize the entire flat. As they thrive in many sorts of flat soils, from a heavy mud to a slightly shifting sand, neither clams nor any other shellfish (except razors, *Solenomya*, *et al.*) have a chance of existence. I do not state that the worms, etc., destroy the clams (they may, however, to some extent), but that the conditions bringing about the presence of the worms, etc., are decidedly unfavorable to clam growth.

The tubes of the *Clymenella* often project slightly above the level of the flat. The tidal currents bear in their course bits of eel grass (*Zostera marina*), which, catching upon these tube projections, take root in the flat and commence to grow. Though eel grass and mussels thrive under similar conditions, the mussels prefer a firmer and usually a higher flat; so that in many cases the struggle for the possession of certain barren flat areas is, to one familiar with the conditions, a foregone conclusion, though at first sight the forces appear equally balanced. Now a contest is begun between the growing eel grass and the mussel set. If it is an “off year” for mussel spawn, the eel grass may obtain a sufficient start to enable it permanently to occupy the flat. As the spawning season closes, many young mussels, concluding their free-swimming stage, settle upon the stems of eel grass, often covering them completely. If the mussel set is large, as was the case in 1906, the young eel grass is overwhelmed by the great numbers of tiny mussel larvæ that attach to it by their strong byssus threads. These mussels now grow rapidly, many by December having passed the half-inch mark. Sediment and shifting sand “catch” among them. The original eel grass is smothered by its overload of mussels, sediment and sand, while the mussels, thoroughly fastened to the flat, continue their growth unmolested. In November and December, 1906, I kept track of an extensive 1906 set of mussels that had come upon several acres of the north central portion of Egobert’s Flat, formerly a favorable clam area. In many places two-thirds of the surface was completely covered by these small, closely packed mussels,—a genuine mat. A set nearly as large has come upon the east central portion of White’s Flat.

Upon digging a flat formerly “wormy,” but set with mussels (no longer, it may be, than six months), one finds comparatively few worms. *Clymenella* are scarce, though *glycera* and similar species still are numerous. *Solenomya* and *synapta* are rare. Where mussels have grown for some time, one finds almost no worms of any sort,—just the mussels, which, though the inshifting of sand among them

and their ability to retain the sediment deposited upon them, build the flat up, in some localities two or three feet in a very few years. The disintegrating mussel shells also contribute to this elevation. The surface of the raised flat is new soil. Also, where eel grass has begun its growth upon a "wormy" flat the worms decrease in number, and upon thickly covered areas the number of worms is comparatively small, frequently none being found.

If by any chance the mussels decrease in numbers, from ice erosion, "cockle boring," etc., unoccupied spots occur in their midst, whereon clam larvæ settle. They grow well upon this new soil, as I have observed in many places, and in time may occupy all the spaces left vacant by the mussels. As the clams burrow well into the soil, they are destroyed less readily by ice action and cockle boring than are the mussels. Hence under favorable conditions the clams may in time reoccupy the entire flat; thus completing a cycle from clam depletion to clam restoration. Before the soft-shelled clam became so important an article of diet, I have no doubt that this rotation of life, or others similar, obtained universally. Constant digging, etc., checked this rotation, which, now that the flats are little molested, has begun once more. We may either await nature's readiness, or else hasten her processes.

Suggested Methods for reclaiming Unproductive Flats. — (1) Perhaps, by setting out eel-grass upon certain areas now "wormy," matters may be hastened; (2) perhaps we may greatly assist by removing mussels from flats that have built up rapidly. This entails great expense. If farmers and gardeners would use the mussels for fertilizer (in England there is so great a demand for mussels for use upon the farms that the supply is protected by law), a profitable method of gaining excellent clam areas would be found. Though in walking over mussel-covered flats one sinks deep down into the soft black mud, the flat when cleared of the mussel mat becomes firmer and harder, suitable for the best clam culture. Portions of Wind Flat, Plymouth, upon which we planted a number of clam beds, illustrate this. (3) A solution of the problem might result in depositing a layer of pure sand or fine gravel over the surface of flats so affected. This, however, is an expensive method, and entails hard labor. The material from harbor dredging might be so utilized in an inexpensive way. The Plymouth "dump," from dredging nearly ten years back, has furnished excellent clams, when the undisturbed flats about it were barren. Is there not some other way of getting rid of the worms, synapta, solenomya, etc., or of removing the cause of their occupation, than by going through the tedious process of eel-grass and mussel-set occupation? (4) Why not turn over the flat, or plough it under? Will not this afford a better chance for the beneficial action of the sun, air and water upon the sub-soil of the flat? If this is done in the winter season, will not frost action be of assistance upon the newly

exposed soil? Is not the digging over of a clam flat simply a speedier way than nature's "worms-eel-grass-mussel-ice-and-cockle method?" There is a right way somewhere; this we wish to find.

One thing cannot be overemphasized. Clam flats, of which the vast areas at Plymouth are a good example, cannot be re-seeded with clams merely by sowing them upon the flats (certain sandy areas and those recently dug out of course excepted). *Before they are seeded the flats must be worked.* The best we may do is to assist nature's processes. The practical method for this is yet to be learned.

We wish to express our thanks to the selectmen of the town of Plymouth for the assistance they have rendered us in furnishing men and boats. We also thank Capt. Alfred Holmes, who has warmly aided us in many things, and other men of Plymouth and Kingston, as well as many living upon the North Shore and along Cape Cod. We will most gladly receive suggestions and ideas for further experiment. What is for the benefit of one is an advantage to all. We aim to determine what is the easiest, cheapest and speediest method of profitable and practical clam culture upon the tidal areas of varied types within this Commonwealth.

Methods of Work along the Coast, chronologically arranged.—The last of July, with C. B. Coulter of Williams College, I began a series of experiments upon the Plymouth flats, to determine what areas were then in condition to grow clams. After examining the beds previously laid out in the harbor, wherein the clams had for the most part died, we began a series of new experiments.

We desired to learn not the capacity of the flat for clams, gained by the usual bed of two dimensions, but the ability of the flats to grow any clams at all. Hence we used a new type of bed, planting between two stakes 4 to 8 feet apart a single row of clams, the larger at one end, or else shore clams near one stake and flat clams near the other. We planted about 75 such beds, as well as other beds of a different sort, upon practically all of the possible clam flats of the harbor. With the aid of Capt. Alfred Holmes, we usually dug the clams during one tide and planted them during the next. We also made numerous towings in the various parts of the harbor, with a plankton net of silk bolting cloth. The young clam larva passes the first few days of its existence in a free-swimming stage, carried about by the waves and tides. We procured great numbers of these young clams, as well as mussel larvæ, in the towings. The larvæ of these two species of shellfish far outnumber at this season of the year, at Plymouth, the larvæ of all other species combined. Coulter preserved many of these larvæ, and made drawings of others for future study. Also, we kept records of the daily temperatures and measurements of the force and times of the tidal currents on several flats.

About the middle of August we examined the Newburyport and Salisbury flats. By constant measurements of clams of all sizes from

many of these flats a comparison of the rates of growth was obtained. We studied the growth lines on the shell, to determine the ages of the various clams and the rapidity of their growth both in winter and summer. Upon certain flats we could easily tell the ages; but where there was constant digging, especially in clay soil, in which burrowing is difficult, the task was not so simple. Though we searched for traces of the 1906 summer set of clams upon the flats, we found none; nor in any of our towings at this time did we find one clam larva. A study of many adult clams revealed mature eggs and active spermatozoa, showing that the spawning season was near at hand.

A dozen or more clam beds planted in the spring upon Plum Island Sound and its tributaries gave rapid rates of growth, disclosing the importance of the current as the great factor in clam development. About August 24 we reached Ipswich. Here our earliest towings contained a few larvæ, which occurred more numerous as time advanced. We now carefully examined many Ipswich flats, finding no trace of 1906 clam set, though we were expecting to find tiny clams any day. The very last of August, Tom Roberts, an experienced Ipswich clammer, while digging on the middle area of Foresides, showed us a few very small clams, about $\frac{1}{25}$ of an inch long. The same tide, farther out, I found other young clams, many with bits of the fine filaments of green algæ fastened to them. Here and at this time only, did I notice algæ fastened on many of the clams. Elsewhere I found the young set only on the flats and upon a rippled area, firmly fastened by their relatively strong byssus threads to the sand grains. They were usually burrowed also. In a day or two I discovered clams, 1,000 per square foot, upon the southeast side of Plum Island, South Middle Ground. From this time on we examined many flats, finding on some young clams, upon others no trace of set. Upon several Essex flats we noted a small set at this time, the first week of September, when we examined carefully our 40 experimental beds in the Essex basin. At Squam we found only a scattering set, when we were examining several clam beds planted there the previous year.

September 15, Mr. Coulter returned to college, leaving me to continue the work of studying this rapidly increasing set. The 20th of September F. C. Lane of Boston University assisted for ten days in noting the localities of the clam set, as well as the conditions and forces that induce the set upon some flats and not upon others. With this end in view, he carefully mapped out several of the flats.

Upon Foresides, a famous Plum Island Sound flat, I tried a number of box and netting spat collectors (designed to collect great numbers of young clams for transplanting, while yet in the free-swimming stage). I could obtain abundance of larvæ for study, $\frac{1}{50}$ to $\frac{1}{25}$ of an inch long; but spat collecting, at least as I conducted it, was not practicable for clam culture.

All this time we were carefully noting the conditions of the mature

clams, now at the height of their spawning, as well as examining many towings, in which a great variety of larvæ was found. There was much difficulty in surely identifying the larvæ of each species. A comparison with the larvæ found upon the south side of Cape Cod, where the shell life is very different, materially assisted us in this identification. Many photo-micrographs were taken of the clam larvæ in their several stages, as well as of the young of other species of mollusks.

Specimens of the young clam set from a number of flats were collected at intervals during the fall, and preserved in order to determine average rates of growth. I found that certain flats received the set weeks before other flats. The reason for this irregularity of set is very difficult adequately to explain. By the middle of October the numbers of larvæ in the tows, as well as the numbers of tiny set upon the flats, became very small. The spawning was on the wane, but the huge set over a large number of flats was in thriving condition. That the current was the prime cause of the set of young clams became increasingly apparent.

It is comparatively easy to visit the distant Plum Island Sound flats from the coal wharf at Ipswich, for daily many clambers in their gasolene launches make the trip. Most of our visits have been with Samuel Killbourne, in his 16-foot, $2\frac{1}{2}$ horse-power dory. We wish to thank Alvah Perkins, Emory Hall, William Jewett, Samuel Killbourne, Tom Roberts and many others for the assistance they have rendered us in our work at Ipswich.

The 20th of October I revisited Plymouth. At once I examined the August beds, none of which contained living clams except those upon new soils, upon shifting areas and upon the gravel beds along the shore. The set of clams for 1906 upon several of the flats was carefully studied. From towings a few larvæ were obtained, as well as some tiny larvæ newly settled upon the flats, from $\frac{1}{50}$ to $\frac{1}{25}$ of an inch long. Here, as well as at Ipswich, the spawning season had drawn to a close. Several new experiments were started by turning over the soil upon several flats and then planting or sowing the clams. In making these experiments of October, as well as those of August and July, we wish to express our thanks to the selectmen of the town of Plymouth, who through Capt. Alfred Holmes have supplied us with boats and men. Plymouth has a most difficult problem before her in the effort to restock the barren flats. We have already learned much of what not to do, and that persistent and careful experimentation is needed to determine the correct methods for practical clam culture. Early in November a number of samples of water from Plymouth harbor when analyzed showed no injurious elements in dangerous quantities.

About November 5 I returned to Ipswich, to observe the growth and shifting of the young clam set upon the flats studied before. The

spawning season had ended, though clams not longer than $\frac{1}{12}$ of an inch could be found here and there.

With D. L. Belding and C. L. Savery a large number of the experimental beds upon the flats of Plum Island Sound, Ipswich River and the Essex basin were taken up, measured and replanted. We filed a notch in the shell of all the clams put back, in order that at the spring examination their winter growth under varied conditions might be tabulated with accuracy.

On November 13, while studying the outer Rowley clam flats, most of which were barren, I found an unusually heavy set upon Rowley Reef, whence, as elsewhere described, bushels of the 1906 set of clams, averaging perhaps $\frac{1}{2}$ an inch in length, were collected and transplanted upon other areas. If clam sets in such quantity as here found exist in all harbors, the problem of seeding in barren flats is solved. But a set so numerous is rare. The Rowley clambers truly are fortunate in having so huge a set, — more than ample to restock their exhausted areas.

On November 17 I returned to Monomoy Point, Chatham, in order to study the clam set there, and make comparisons with various localities upon North Shore. I also visited for the same purpose a number of other harbors along the south side of Cape Cod. Photographs were taken as opportunity offered.

On December 1 I found that most of our recent Plymouth experiments were thriving; yet the clams planted upon the barren areas had died, as they did in May, July and August. These results simply strengthened our former impressions. The barren areas of Plymouth harbor at present are in no condition to receive a sowing of clams, be they large or small, from shore or from flat areas. Some preliminary work upon the flats is necessary.

On December 4 the Gloucester flats, buried by the dumping from the recent dredging, were examined; on account of snow and ice, study upon the flats and out-door experiments have been suspended, except for chance visits in times of mild weather.

In describing hastily our methods of work in a chronological order, we wish to add that any suggestions as to new lines of experiment or ideas in conducting our present work are most gladly received. Our first aim in this work, our ultimate study, is to determine the possibilities and most practicable methods for restocking the barren clam areas. But to attain this end, even in a small way, it is essential that we become familiar with the life history of the clam, its habits and enemies, its food and growth, as well as with the areas upon which it now thrives and those from which whenever planted it seems always to perish. This work is primarily to benefit the clambers of each harbor. We thank them for their assistance, and ask for further help in our work during the year 1907.

SUMMARY.

A Biological Survey of the Clam Area of Massachusetts.

During the past year we have studied clam growth in many towns of the State,—Bourne, Harwich, Chatham (including Monomoy Point), Provincetown, Plymouth, Kingston, Boston, Lynn, Gloucester (Squam), Essex, Ipswich, Rowley, Newbury, Newburyport and Salisbury. Other towns have also been visited. We have (1) noted the areas now productive of clams of various grades; (2) looked to the relative abundance or scarcity of the clam set; and (3) studied rates of growth in various soils on flats of different heights. The effect of the currents has been regarded particularly. We are gradually accumulating material for a reliable estimate of the present actually productive clam area of this State. It is small, and much of it scarcely may be called clam area, so few are the clams thriving upon it. Also we are collecting material for an estimate of the *possible* clam area of the State, which is much more extensive. To do this, a large amount of experimentation is needed with the different soils and the varying conditions and forms of life that obtain upon these areas. In fact, a pretty complete life history, as well as a careful study of the possibilities of clam culture, are essential before we can, even with approximate accuracy, map out the available clam area of Massachusetts.

The Action of the Currents.

In closing this preliminary report upon the soft-shelled clam, I wish to emphasize one point,—the action of the *currents*. Success in raising such shellfish as the oyster, quahaug and clam, depends largely upon the regard that is given to the water currents that flow over the seeded areas. By the action of the currents is meant the effect of wave beating in wind storms, the movements of the tides and the outward motion of the water in the rivers; in fact, any movement of the water of our harbors, whatever the cause. However, the chief factor of this action is the tide.

I. The action of the current determines the very structure of the flats.

(1) If a strong incoming tide washes a flat near the harbor mouth, inevitably it becomes very high, sandy and shifting, as illustrated by the "Spit" or a part of "Wheeler's," near the mouth of the Essex River.

(2) If a strong current simply passes a flat, lying snugly between two rocky or sandy points that receive the force of the water, a large amount of fine sediment is deposited, forming a clay flat. "Lufkin's," by Ipswich Bluff, is a good example of this sort of flat.

(3) A strong current near the harbor mouth may cause a marked eddy, that deposits a soft mass of the finest sediment over the center

of the flat, rendering it utterly unfit for clam growth; *cf.* "Lobster Cove," just to the north of Little Neck on Plum Island Sound.

(4) If the current is but fairly strong the sand deposited becomes finer, and upon these areas are the best localities for clam growth; *cf.* "Middle Foresides," the eastern portion of "Wheeler's" and of the "High Sands."

(5) As the current decreases in force upon the inside of the flats or near the harbor's head, the deposit is entirely of mud. Upon this clams grow in great numbers, it may be, but slowly, as illustrated by parts of Pine Creek flats, certain areas in Ipswich, the upper Powder Hole flats at Monomoy Point, several of the clam grants of Plymouth.

(6) Upon certain areas, as off shore from Frank Cole's boat yard in North Plymouth, or South Seniorita in Ipswich River, the extremely slow current rapidly deposits mud too soft and deep for clam growth.

The current determines as to whether the flat shall be high or low, sandy or muddy, of gravel or of clay.

II. It also determines the enemies of the clam. The difficulties to be overcome by the clams upon a sandy flat are almost the reverse of those upon an inward area of mud. The shifting flats never support eel grass or mussels. High, stony spots also are bared of mussels. A fine, sandy area is free from the fine smothering "slime" of the mud areas of slowest current. The cockle is less numerous upon the most sandy flats, but upon these ice causes the most harm.

III. The current regulates the amount of food. In a harbor thoroughly well drained at each tide the distribution of diatoms is fairly even throughout all the waters, perhaps increasing in number over the muddy areas. With an increase in current a larger quantity of food is brought to the clam. Where the current is extremely slow over a thickly set area, one clam may take in what its next neighbor has cast out. In such a case, is there any wonder that growth is slow and that the clams are stunted? Up to a certain speed, the more current there is over a clam bed the more rapid is the growth.

IV. In the fertilization of the clam ova the current performs its part,

V. as also in the development of the larvæ during the veliger and crawling stages.

VI. After the young larvæ have become firmly set upon the flat, the wave action and tidal washing distribute the clams over unset areas. This is done during the entire life of the clam. At times the results of this action are disastrous, rather than purely beneficial. Certain further and less obvious effects of current action have as yet scarcely been observed; such are ice action, the work of spring freshets, river bed gougings, etc. During the coming year we plan further work along these lines.

VII. Lastly, but perhaps most important of all, is the action of the current in causing the set of clams. This is briefly treated else-

where in our report. A set is caused by the "spread of the water upon the side of a current;" in other words, a relatively strong current is checked to some extent, and here we find the heavy set of young clams. It may be caused by a pronounced eddy; or by a sudden bend in the current, due to a projecting rocky point or sandy reef; or, as in the majority of cases, simply by an inspreding of the water over a flat at the side of the channel. This is ever changing with the tide; its force, its position, its depth, vary every hour of the day. In many harbors the incoming current takes a course far different from the outgoing, building up its own flats and causing its own sets.

A richly set, productive clam area is the combined result of all forces that set in motion the water of the harbor. Other factors play their minor parts, but the currents the most important. Further study of the life history and habits of our clams, as well as of possible areas for growth and of methods of culture, can be undertaken only with due regard to this all-important factor, — the action of the currents.

The Lobster. — Three important questions upon the lobster fisheries appear to be fully decided in the public mind.

First, the lobster supply is annually decreasing, and this decrease is most obvious in the neighborhoods of the great markets of New York, Rhode Island and Massachusetts. The commercial extinction of the lobster in these sections is imminent, and a decrease is even now beginning to appear in the great fisheries of Maine and the British Maritime Provinces.

The following figures, derived from the sworn statements of the fishermen, tell of the conditions in Massachusetts. We are of the opinion that the real conditions are even more deplorable than the figures indicate, for the reason that our blanks reach a larger number of fishermen and are now more carefully filled out than formerly. This table also includes, under 1906, the lobsters caught in Massachusetts waters, but marketed at Newport, Rhode Island. In some previous years these have been omitted.

DATE.	Fisher- men.	Traps.	Number of Lobsters above Ten and One-half Inches.	Egg-bear- ing Lobsters.	Average Catch per Pot.
1888,	367	21,418	1,740,850	—	81
1889,	344	20,016	1,359,645	61,832	68
1890,	379	19,554	1,612,129	70,909	82
1891,	327	15,448	1,292,791	49,973	84
1892,	312	14,064	1,107,764	37,230	79
1893,	371	17,012	1,149,732	32,741	62
1894,	425	20,303	1,096,834	34,897	54
1895,	377	17,205	956,365	34,343	56
1896,	453	22,041	995,396	30,470	45
1897,	388	18,829	896,273	23,719	48
1898,	340	16,195	720,413	19,931	44
1899,	327	15,350	644,633	16,470	42
1900,	309	14,086	646,499	15,638	46
1901,	331	16,286	578,383	16,353	35
1902,	410	20,058	670,245	—	34
1903,	309	20,121	665,466	—	33
1904,	326	19,539	552,290	13,950	28
1905,	287	13,829	426,471	9,865	31
1906,	335	21,918	487,332	9,378	28

A correspondent of the "Fishing Gazette" says, under date of Feb. 10, 1906:—

There weren't as many lobsters packed in Newfoundland last year as the year before. The reasons assigned are: the lobster is getting scarcer and smaller from overfishing, and the superior inducements of the codfishery drew many packers in the latter direction. We estimate the pack at 30,000 cases, which at \$12 a case gives a value of \$360,000, or \$40,000 less than 1904.

The "Coast Guard" (Nova Scotia) says that "the lobster season winds up [June 29] without fulfilling the fair promise of its opening."

In December, 1906, the "Coast Guard" also says:—

Scarcity of lobsters is reported all along the shore. Since the beginning moderate weather has prevailed, but the high course of tides has created and kept up a heavy sea. This has been unfavorable, but in the opinion of most fishermen it does not account for the general shortage. It may be that we are spoiling the breed by not sparing the babies. Others say it is owing to the severe cold before the season opened; while a few think the tons of fish offal thrown overboard by the big boats while returning from codfishing during the fall has a bad effect. There may be something in all of these answers, but we remember severe cold snaps before the season opened that did not prevent a good catch before the season closed.

Second, the present laws are responsible for this rapid decline. Practically all the laws are based upon the Massachusetts law instituted in the early '70's. The same salient fallacies appear in every lobster law at present in force; namely, that these laws are extremely difficult of enforcement, for the reason that they permit the sale of short lobsters and of meat by *permitting the capture* of illegal lobsters. It is an inherent weakness in any law when such a law permits the capture or handling, in any form whatever, of the prohibited articles. An important factor, too, in rendering the enforcement more difficult is the fact that the public demand lobsters between 8 and 10½ inches.

The present law, having as its cardinal feature the prevention of the killing of any lobster below 10½ inches, was man's first attempt at legislation upon a peculiar problem. This attempt was undertaken with a lack of knowledge of the habits and of the life history of the lobster. On account of the enormous number of lobsters in the ocean, the original advocates of the law were led into the erroneous belief that any inroads which man might make could have no effect upon the number of lobsters in the ocean. But with the increasing population and the enlarged demands, with wide-spread prosperity, which permits the payment of higher prices, the demand has constantly increased, and the results are obviously a tremendous decline in the total number of lobsters in the ocean. This condition is, however, somewhat masked by the fact that the development of power boats has enabled the fishermen to tend a larger number of pots, to extend their operations over a wider area and for a

greater number of days in the year. For these reasons, the actual condition of the lobster supply in the ocean is not reflected accurately by the market reports or by the statements of the fishermen and of the dealers. The present law has had a fair trial during the past thirty years, and has proved inadequate. What, then, is the fallacy? One has but to compare the present lobster law, which permits and even puts a premium upon the capture of the adults, with the universal practice which has been found necessary in the case of other animals; namely, the selection and protection of the breeders, and the utilization of the immature young to meet the market demands, if we would maintain our supply of domesticated animals and plants up to a point where the reasonable demands of man could be met.

The third point upon which the public is agreed is, *that the lobster is commercially worthy of the utmost consideration*. All substitutes have proved unsatisfactory. The crab, the crayfish, the prawn and the shrimp have their places, but the American lobster is inimitable. In view of all these facts, it is plain that the future market history of the lobster is dependent upon the correct interpretation of these observations, and an immediate application of the remedy by the States interested.

Of all of the plans advocated for meeting these conditions of the decline of the lobster, three are most prominent:—

First, artificial propagation. This necessitates protection of the eggs. Usually the lobster is killed after the eggs have been removed; but during the past few years a greater number of lobsters bought by State and government officials, from which the eggs have been taken, have been liberated. The efficiency of such a measure would, of course, be greatly increased if the protection of the fertilized eggs could be extended to the parents of those fertilized eggs, in order that subsequent litters of eggs might be produced. This work has been carried on very largely by the United States Fish Commission for many years. It has the very great merit of saving from destruction the eggs which the short-sighted, selfish fishermen would have destroyed if the government and the State had not purchased those lobsters at a price equal to, or somewhat above, the market price. It also, incidentally, is subject to the criticism that there is undoubtedly a greater loss in hatching, and a greater loss in the distribution

of the just-hatched lobsters, than would have been probable if the lobster had been allowed to hatch and distribute the young in its own way. With increasing knowledge and the efficiency of men and measures, many improvements have been incorporated into this method. The most noteworthy are those developed under the auspices of the United States Bureau of Fisheries and of the Commission of Inland Fisheries of the State of Rhode Island, under the direction of Drs. Bumpus, Mead, Gorham and Sherwood, which are now being developed at the Experiment Station of the Rhode Island Commission at Wickford, R. I., and at the Hatchery of the United States Bureau of Fisheries at Boothbay, Me. It should be noted, however, that all these attempts at artificial propagation must start with the protection of the adult, for the purpose of securing the eggs. With the decline in the number of adults, there must be a corresponding decrease in the number of young hatched each year. We believe that the statistics offered above indicate this. These statistics are based upon the sworn statements of the fishermen of Massachusetts, and show conclusively that there has been a tremendous decline in the number of egg-bearing lobsters, a marked decline in the size of lobsters caught, and there must follow necessarily a decline in the number of eggs laid, for the reason that, as Dr. F. H. Herrick points out, a $10\frac{1}{2}$ inch lobster lays only 10,000 eggs, while a 14 or 16 inch lobster may lay 60,000 to 90,000 eggs. Thus, by continually catching the largest lobsters, we have seriously impaired the annual reproductive capacity of the race. Our statistics indicate that in 1890 there was 1 egg-bearing lobster to every 22 lobsters taken; in 1905 there was 1 egg-bearing lobster to every 43 lobsters taken; in 1906 there was but 1 egg-bearing lobster to every 52 lobsters taken.

The difficulties connected with artificial propagation are many, on account of the peculiar characteristics of the lobster, *e.g.*, the rate of growth is exceedingly slow. From all the evidence thus far gathered it is probable that it requires from four to seven years for a lobster to reach the length of $10\frac{1}{2}$ inches, the rate of growth varying with individuals. Normally, the rate of reproduction is slow, especially with small lobsters. The eggs appear to be laid only every two years, and require from

ten to eleven months in hatching; so that even if a large lobster, say 16 inches, produces 80,000 eggs every two years, the per annum yield is cut in half; whereas, if the breeding is restricted to the small lobsters below 10½ inches, the annual yield of eggs is correspondingly not over 5,000. The young are exposed to a great number of enemies. In successful cultivation of food fishes the greatest gain is made through protecting the young from the enemies peculiar to that stage of existence. In the case of the lobster, however, it is extremely difficult to rear them under artificial conditions, on account of their notorious cannibalism, the difficulty of securing a proper and easily procured cheap food, and the difficulty of preventing the growth of various diatoms and possibly also bacterial diseases which may kill or starve the young lobsters. Apparatus to meet all these difficulties has been devised by the workers in the Rhode Island Fish Commission, but at the present it seems rather a personal triumph over difficulties than a commercial proposition.

Close season. The other and most promising proposition, particularly when taken in connection with the continued work upon the problems of artificial propagation, is to be found in a close season. This has been urged in many instances. While a close season is undoubtedly the best remedy, and is the one generally first considered for cases which have an apparent similarity to the one before us, it is not by any means equally adapted for all cases. While it is efficient for rapid breeders, and for such as have a breeding season limited or at least not extending over six months, a close season for a portion of the year would be entirely ineffective in the case of the lobster, which carries its eggs for ten or eleven months after laying.

During the month of July the lobsters resort to harbors and protected places, and there shed the shell; during this one month, when they could be taken with the least destruction of eggs, they are practically unmarketable on account of the soft shell; therefore, the only close season which can promise any degree of permanent benefit is a close season upon all lobsters for a term of years.

In order to be at all effective in protecting our lobsters during the close season, the law should forbid the sale or possession of any and all lobsters, whenever and wherever taken. Such a

law obviously carries too great a hardship to the fishermen, to vested interests and to the public.

There is, however, a modification of the close-season idea, which was at first, we believe, advocated in 1902 in a report to Capt. J. W. Collins, then chairman, which is, that a perpetual close season should be placed on all adult lobsters and upon all lobsters below 9 inches. Such a measure presents no similarity to the ordinary 9-inch law, which permits the capture of *all* lobsters above 9 inches; but it combines the advantages of such a 9-inch law with the benefits of a close-season law for an extended period; *i.e.*, it permits the catching of lobsters above 9 inches, which are of least value in maintaining the species, and puts a close season upon those above $10\frac{1}{2}$ inches, which lay the greatest number of eggs, and eggs of the best quality for producing the strongest progeny.

Number of Egg-bearing Lobsters collected by the Launch "Egret" during the season of 1906, divided according to their Various Lengths.

Size (Inches).	Number collected.	Size (Inches).	Number collected.	Size (Inches).	Number collected.
$7\frac{3}{4}$	1	$11\frac{1}{4}$	149	$14\frac{1}{4}$	11
$8\frac{1}{2}$	1	$11\frac{1}{2}$	294	$14\frac{1}{2}$	19
$8\frac{3}{4}$	1	$11\frac{3}{4}$	143	$14\frac{3}{4}$	10
9	4	12	23	15	13
$9\frac{1}{4}$	7	$12\frac{1}{4}$	382	$15\frac{1}{4}$	5
$9\frac{1}{2}$	26	$12\frac{1}{2}$	377	$15\frac{1}{2}$	5
$9\frac{3}{4}$	36	$12\frac{3}{4}$	226	16	1
10	128	13	316	$16\frac{1}{4}$	1
$10\frac{1}{4}$	58	$13\frac{1}{4}$	75	$16\frac{1}{2}$	3
$10\frac{1}{2}$	299	$13\frac{1}{2}$	86	17	3
$10\frac{3}{4}$	165	$13\frac{3}{4}$	32		3,382
11	388	14	94		

Number to and including 11 inches, 1,114
 Number above 11 inches, 2,268

The ordinary 9-inch law, permitting the catching of everything above 9 inches, would be calamitous to the lobster industry.

Note in the above table that only 7 out of 3,382 breeders were 9 inches or less. From this it may be inferred how enormously the reproductive capacity of the race is being reduced by legal capture of the adults.

The present suggestion, however, is entirely different, since it provides for a close season upon the adult and upon the smallest lobsters, permitting the catching only of those between 9 and 11 inches. The present chairman of the commission in 1902 made an investigation of the question, at the instance of His Excellency Governor Crane, and Captain Collins, then chairman of this commission. His report in no way covered the question of the expediency of such a change in the law; he merely called attention to the scientific basis of the law. As the present chairman of the commission, it is his duty to consider in addition the expediency of such legislation, and to call attention to the fact that such legislation is entirely untried, and is a theory, pure and simple. Nevertheless, it is a theory, or rather, *a biological principle of action, which has been applied with success to whatever animals and plants man has found necessary or possible to domesticate; and has been proved to be an absolutely essential procedure if we would maintain and increase the supply of such domesticated animals and plants.* It is, therefore, not entirely a new theory, but merely the application of an old theory to a new case. The results of such a law are not susceptible to proof until the evidence can be furnished by the actual observations upon the effects of such a law.

It is important, in a case like the present, to give greater attention to the objections to such a law than to the advantages. These objections appear to be at least five.

First of all, it is not uniform legislation throughout the lobster-producing States, and there is a possibility of working hardship to other States. For example, undoubtedly from Maine there would be a tendency to divert the 9-inch lobsters to the Boston market; and Maine would then be in the same position with reference to Massachusetts and the States south as is to-day Massachusetts in reference to the 9-inch laws in force in New York and Rhode Island. Should Massachusetts pass the suggested law, protecting the adults and permitting the sale only of those lobsters between 9 and 11 inches, the other States

and Provinces would probably find it to their advantage to follow with similar laws.

Secondly, the law is on its face more difficult to enforce, because two measurements, the 9-inch as the lower limit and the 11-inch as the upper limit, are necessary. The difficulty of dealing with the upper limit can, however, be remedied by the use of a pot with a legalized ring (of such inside measurements as would prevent the entrance of lobsters above 11 inches), and an inspection and registration of the pot, instead of the inspection of the lobsters. According to our observations, the catches made by pots with various-sized rings indicate that, in a total of 534 caught in these pots, a smaller number of lobsters above 11 inches are caught by the pots with the smaller rings; and that the average length of all the lobsters entering the pots having a ring 3 inches "inside in the clear" was 9.9 inches, in a $3\frac{1}{4}$ -inch ring 10.4 inches.

These figures show merely that the smaller rings permit the catching of the smaller lobsters, and in general prevent the entrance of the larger lobsters which have reached the breeding size. A $3\frac{1}{4}$ -inch ring will permit the entrance of lobsters even as large as 11 or 12 inches, but the average size is $10\frac{1}{2}$ inches; while the average size of all caught by the $4\frac{1}{2}$ -inch ring was 12 inches, including some as large as 15 inches and many above 12 inches in length.

The law should provide for the size of the entrance ring. There should be a space of at least $1\frac{1}{2}$ inches between the slats. The law should provide for the official inspection and sealing of the traps, and all traps not conforming to these specifications should be liable to confiscation wherever found. Any one setting an illegal pot should be liable to a fine. The law should seek to prevent the destruction of lobsters which are so small as to be below the size for most profitable use. Such a law would do away with many of the uncertainties connected with the measurements now necessary, and with abuses and evasions too frequently connected with a standard so arbitrary as a definite measurement. The situation in Maine is well described in the following clipping from a Portland paper:—

Plans for a change in the measurement of lobsters, to determine the minimum length a crustacean must attain before it is offered legally

for sale, are meeting with much opposition on the part of the fishermen of this State, who yearly obtain a large income from the lobster industry. At present a lobster is measured from his nose to the tip of his tail, and should obtain a length of at least $10\frac{1}{2}$ inches. Sometimes, when the crustacean falls a trifle short of requirements, the fishermen, it is said, have stretched the tail, and by this method have caused wardens much trouble. The new method proposes to have the measurement made from the tip of the nose to the base of the tail only. Warden M. J. Hanna of this city is at present studying, with some of the large wholesale dealers who supply the Boston and New York markets, the mean length to be fixed for this much-prized delicacy. For this purpose several hundred crustaceans are being experimented with.

Should the efforts of Mr. Hanna prove successful, a determined effort will be made by him and his associates to have the Legislature repeal the old law and adopt the new one to be recommended. The fishermen are vigorously opposing any suggested change. They claim that lobsters are very scarce now, and that anything tending to restrict further their business would mean ruin.

The third objection is the injuries to vested interests, — to capital invested in the lobster business. It is a fact that such a bill, if it became a law, would reduce the average size of marketable lobsters taken in Massachusetts waters six-tenths of one pound, and more lobsters would have to be handled by the lobster dealers for a given amount of money (in exact figures, 155 lobsters to every 100 lobsters under present conditions).

Undoubtedly, too, the price per lobster paid by the dealers to the fishermen would be on the average correspondingly less than at present; but the price received by the fishermen and others now in the "short" business would be greater, and the cost less to the consumer. On the other hand, the public demand and use a lobster as small as 9 inches; and the use of at least three times as many lobsters as under the present law would, in the opinion of the writer, do less damage to the future supply of lobsters than does the present destruction of lobsters above $10\frac{1}{2}$ inches.

A fourth objection is found in the fact that perhaps in at least two places in Massachusetts the large lobsters predominate in the catch, and therefore the present interests of the fishermen at these places might be injured. But it is not entirely certain that this injury would be actual; and from personal observations

we are convinced that there are even at Cape Cod at least six lobsters between 9 and $10\frac{1}{2}$ inches to every one over $10\frac{1}{2}$ inches, while off Monomoy the 9 to 11-inch law would permit capture of about half of the lobsters at present taken.

A fifth and most important query is, Will enough lobsters escape the critical period of 9 to 11 inches and pass into the exempt class, where they can be sure of an extended period of egg-producing usefulness? This is entirely problematical, and there is at present absolutely no knowledge bearing upon the case. It is a fair presumption that enough would so escape. In any event, the lobster would have, under the proposed conditions, — exemption from capture after reaching the point of 11 inches, — far greater opportunity to lay a larger number of eggs than under existing conditions; since under the present laws not only every lobster above $10\frac{1}{2}$ inches is exposed to capture, but, as a matter of fact, a greater number of those between 9 and $10\frac{1}{2}$ inches or even smaller are captured, in spite of all the machinery of law enforcement which can be brought forward. The fact that lobsters on the average increase 15.6 per cent. at a moult is of importance. Thus, a 9-inch lobster would become $10\frac{1}{2}$ inches in one moult, and a $9\frac{1}{2}$ -inch lobster would become 11 inches, and thus exempt. Many individuals would pass within a few days entirely beyond the legal size for capture; and the actual length of time which a lobster requires to pass through the dangerous period of adult life (*i.e.*, from 9 to 11 inches, the only period when exposed to legal capture by man) may be, after all, relatively brief for any one lobster, practically during not more than two moults, probably not more than four years at the maximum. Yet there should be such a number of individuals as to satisfactorily supply the market.

Our experience with the present laws dates from 1873. Since that time, even with the protection of a certain number of adults by purchase of egg-bearing lobsters and the hatching of eggs by the United States Bureau of Fisheries, and in spite of the fact that the $10\frac{1}{2}$ -inch limit was fixed at a point where the lobster had an opportunity to produce at least one litter of eggs, there has been a gradual decline in the catch of lobsters in Massachusetts from 84 per pot in 1891 to 28 per pot in 1904; and from 1 egg-bearing lobster to every 22 lobsters above $10\frac{1}{2}$

inches in 1890 to 1 egg-bearing lobster to every 52 lobsters above $10\frac{1}{2}$ inches in 1906. The present laws are difficult to enforce: first, the public demand for 9 to 11 inch lobsters is strong; second, it is easy to destroy the evidence that a lobster was below the legal limit of size; third, the law is easily evaded, and therefore tempting; fourth, it is not practicable to properly safeguard the law-abiding fishermen. Honorable men throw overboard the short lobsters from their traps, and see these caught the next day by unscrupulous neighbors.

In the opinion of this commission, the lobster is approaching commercial extinction. In the neighborhood of the great markets, *i.e.*, in the waters of Connecticut, Rhode Island and Massachusetts, the decrease is especially evident; yet the biological conditions and the productive capacity of the area still remain essentially the same as they did when these same waters produced at least ten times the number of lobsters that they do to-day. Under wise laws, these waters might again produce as many lobsters as they did twenty or more years ago; but, in order to produce again the requisite number of lobsters to meet the demand, not only must there be protection for *all* the adults of breeding age, but active measures must be taken for placing the artificial lobster industry upon a commercial basis, when the value of the number of young lobsters produced will be in dollars and cents greater than the actual cost of production. The trout, shad and oyster industries have reached that stage. The lobster industry at present has not; but the outlook is promising, and appears to lie through the protection of the breeders, supplemented by protection of the just-hatched young up to such a stage as they are able to care for themselves on the bottom of the ocean, either after the methods developed by Bumpus and Mead in Rhode Island, or by the method of specially protected breeding reserves or nurseries for the young; and on this your commission hopes to have something to report next year.

In conclusion, we may say that, for the interests of the Commonwealth and of the lobster, a new law, restricting catching to those lobsters between 9 and 11 inches, and putting a close season upon both males and females above 11 inches, is without doubt a step far in advance. It is not a departure so radical as it appears to the popular mind at first glance. The close-season

law has many obvious advantages, and the protection of the adult lobster is already in practical operation to a limited extent. The proposed measure is a combination of "close season" and the "9-inch" laws; and, though essentially a compromise measure, it embodies the advantages of both with the disadvantages of neither.

Finally, such a law as would permit the legal catching and marketing of any lobster between 9 and 11 inches, except those with eggs attached, would readily meet the market conditions in all the States and the Maritime Provinces. It would permit fishing to be carried on at all seasons, for the close season would then be upon only *a part of the lobsters all the year*, instead of upon *all the lobsters for a part of the year*.

During the past four years this modification of the law has been carefully considered, and now numbers among its adherents many persons whose intelligence is unswayed by personal considerations, since they are interested in the lobster neither as fishermen nor dealers, and whose opinion is, therefore, of greatest weight.

This proposed measure has the written endorsement of such eminent investigators in marine biology as: —

Prof. F. H. Herrick, special investigator of the American lobster for the United States Bureau of Fisheries.

Prof. W. K. Brooks of Johns Hopkins University, director of the Chesapeake Zoölogical Laboratory.

Prof. C. O. Whitman of Chicago University, director of the Marine Biological Laboratory at Woods Hole.

Prof. E. L. Mark, director of the Zoölogical Laboratories, Harvard University.

Prof. J. S. Kingsley of Tufts College, director of the Marine Laboratory at Harpswell, Me.

Prof. Sidney I. Smith of Yale University.

Prof. John M. Tyler of Amherst College.

Prof. E. G. Conklin of University of Pennsylvania.

Prof. Jacob Reighard of University of Michigan.

Prof. William Patten of Dartmouth College.

Prof. J. L. Kellogg of Williams College.

Prof. G. A. Drew of University of Maine.

Prof. H. V. Wilson of University of North Carolina.

Prof. A. L. Treadwell of Vassar College.

Prof. A. W. Weyssse of Boston University.

Prof. Francis H. Herrick of the Western Reserve University recommends a radical change of policy in protecting the young lobster. "The theory of past legislation has been that the young lobster is in greater need of protection than the old one. Hence it was made unlawful to retain (after catching) lobsters below a given limit in size. Some States fixed the dividing line at 10½ inches and others at 9. These standards have been adopted by most of the Canadian provinces, though one or more place it at 8 inches. This regulation is usually supplemented by a second, which prohibits marketing female lobsters that are spawning." Professor Herrick would reverse the first of these rules, and thus make the second unnecessary. One of his reasons for proposing the change is, that "it would protect the female lobster more effectually than existing laws do, for these can be and are often evaded. It is possible for a dishonest fisherman to remove the evidence that he is violating the statutes. Forbid him to have or sell a lobster which is more than 9 or 10 inches long, whether it is spawning or not, and detection and punishment will be easier than they are now."¹

Professor Herrick is the well-known authority on the lobster. His study of the life history and habits of the American lobster while in the employ of the United States Fish Commission will remain classic, and his opinion carries great weight.

SUMMARY.

The Proposed Law combines Close Season and 9-Inch Law. — It would combine the best points of a close season (by putting a close season on all lobsters above 11 inches and below 9 inches) and of a straight 9-inch law (by permitting the legal sale of lobsters between 9 and 11 inches, size-limits which include the largest number of lobsters now caught).

Would be more readily and economically enforced. — By forbidding the use of any pot other than a legal, standard pot, with the seal of the inspector, having an entrance ring not exceeding 3 or 3¼ inches, the law could be more readily and economically enforced, since no large lobster could enter the pot, and the

¹ Cf. Science, N. S., Vol. XXIII., No. 591, pp. 650-655, April 27, 1906.

further possession of large lobsters would be illegal. The lower limit could be controlled by the prohibition of the use of lobsters under 8 inches as bait, or of their possession for any other purpose whatever, except for use in scientific study. The temptation to keep an 8-inch lobster would be less than that involved in the possession of a large lobster. It would give every man in the lobster fisheries an equal chance. The honest man would no longer throw overboard 9 to 10 inch lobsters for the benefit of his less scrupulous neighbor.

Would increase the Number of Eggs produced. — It would immensely increase the number of eggs produced, and therefore the number of young lobsters which would by growth meet the market demand.

Would improve the Quality of Eggs produced. — By perpetually reserving the best specimens of mature age as a breeding stock, the best quality of young would be produced.

Objections. — The chief objections appear to be the difficulty of enforcement, on account of an upper and a lower limit of size (it should be noted that the upper limit can be cared for by an entrance ring of a specified size upon the pots or traps), and the danger that too many small lobsters would be caught.

But the crux of the whole matter is that the present laws result in a diminished yield of eggs, and to this is to be ascribed the obvious and alarming decline of the lobster in all waters where the effects of these pernicious laws have become evident; and we therefore urge upon you a most careful, judicial and prompt consideration of this important question.

In discussing the question, we strongly urge that the matter be discussed and settled for the benefit of all the people of the State, — consumers, fishermen and dealers alike. It is the person from the interior who, after all, is most interested in the maintenance of the lobster supply, — the fisherman and the dealer are too often interested only to a personal and selfish degree; and this matter should not be left to the consideration only of the representatives of the shore towns, many of whose constituents are actively engaged in the lobster business, and are perhaps too deeply concerned in the pursuit of present gain to give an unbiased opinion upon the methods which the Legislature should carry out in pursuance of the duty and responsi-

bility of the Commonwealth as the trustee and conservator of its natural sources of wealth.

Following are reports of the work done by the U. S. Bureau of Fisheries in Massachusetts for the maintenance of the lobster fishery:—

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF FISHERIES, WASHINGTON, Jan. 18, 1907.

Commissioners on Fisheries and Game, Room 158, State House, Boston, Mass.

GENTLEMEN:—In compliance with your request of January 1 to the superintendent of Woods Hole station, there is submitted herewith a brief résumé of the lobster work accomplished at that station during the fiscal year 1906.

Fair results having followed the holding of egg-bearing lobsters through the winter months of the previous year, it was decided to repeat the experiment. Accordingly, 678 lobsters, collected between September 1 and November 23, were placed in live cars and fed regularly to December 20. Feeding was resumed on March 20, and continued to the time of liberation. When removed from the cars late in April, the loss of lobsters during confinement was found to have been 25 per cent. The receipts of eggs from this stock aggregated 5,505,000, or about one-third of the total number handled. They were of good quality, and commenced hatching at about the same time as those obtained from the spring collections.

The eggs received from the spring collections numbered 10,041,000, and from both lots 12,787,000 fry were hatched, and deposited in waters along the Massachusetts coast. The egg collections of the previous year exceeded those of the past season by about 1,800,000; but, taking into consideration the fact that nearly one-third of the 1905 yield were secured from waters outside the State, while the past season's work was restricted to the State limits, the results seem quite encouraging. During the season eggs were taken from 1,187 lobsters, 780 of which were furnished by employees of the Massachusetts commission. The remainder were collected by the Woods Hole station force.

Respectfully,

GEORGE M. BOWERS,
Commissioner.

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF FISHERIES, GLOUCESTER, MASS., Jan. 15, 1907.

Dr. GEO. W. FIELD, *Chairman, Commissioners on Fisheries and Game, Boston, Mass.*

SIR:—I submit herewith a brief report of the lobster work at this station during 1906.

There were 1,398 egg lobsters received, of which number 1,324 were collected by the employees of this station and 74 by the State force.

Of the number collected by the station force, 1,215 were utilized for hatching purposes, and the remaining 109, having new eggs, were turned over to the State.

There were 1,494 egg lobsters used for hatching purposes, including, besides those mentioned above, 205 which had been kept in a live-car since November, 1905. The total yield of eggs amounted to 22,846,000, from which were hatched 20,375,000 fry. The fry was distributed at various points along the coast from Rockport to Cohasset.

Respectfully,

C. G. CORLISS,

Superintendent.

Statement of Fish and Eggs distributed from Gloucester, Mass., Station for Year 1906. Species, Lobster; Age, Fry.

DATE.	To whom delivered.	Address or Point of Deposit.	Waters stocked.	Number.
1906.				
June 11, .	Bureau of Fisheries consignment.	Gloucester, Mass.,	Massachusetts Bay,	900,000
June 13, .	Launch "Egret," .	Nahant, . . .	Massachusetts Bay,	800,000
June 16, .	Launch "Egret," .	Boston, . . .	Massachusetts Bay,	1,200,000
June 18, .	Bureau of Fisheries consignment.	Magnolia, . . .	Massachusetts Bay,	500,000
June 20, .	Bureau of Fisheries consignment.	Marblehead, . .	Massachusetts Bay,	1,000,000
June 23, .	Bureau of Fisheries consignment.	Gloucester, . .	Massachusetts Bay,	500,000
June 26, .	Launch "Egret," .	Cohasset, . . .	Massachusetts Bay,	2,000,000
June 28, .	Bureau of Fisheries consignment.	Rockport, . . .	Ipswich Bay, . .	2,000,000
June 29, .	Bureau of Fisheries consignment.	Manchester, . .	Massachusetts Bay,	1,400,000
June 30, .	Bureau of Fisheries consignment.	Gloucester, . .	Massachusetts Bay,	1,200,000
July 2, .	Bureau of Fisheries consignment.	Rockport, . . .	Loblolly Cove, .	1,500,000
July 5, .	Bureau of Fisheries consignment.	Manchester, . .	Massachusetts Bay,	1,800,000
July 7, .	Bureau of Fisheries consignment.	Marblehead, . .	Massachusetts Bay,	1,100,000
July 9, .	Bureau of Fisheries consignment.	Rockport, . . .	Ipswich Bay, . .	1,000,000
July 10, .	Bureau of Fisheries consignment.	Gloucester, . .	Massachusetts Bay,	800,000
July 14, .	Bureau of Fisheries consignment.	Lanesville, . .	Ipswich Bay, . .	600,000
July 16, .	Bureau of Fisheries consignment.	Hull,	Massachusetts Bay,	500,000
July 17, .	Bureau of Fisheries consignment.	Beverly, . . .	Massachusetts Bay,	400,000
July 19, .	Bureau of Fisheries consignment.	Gloucester, . .	Massachusetts Bay,	600,000
July 21, .	Bureau of Fisheries consignment.	Manchester, . .	Massachusetts Bay,	325,000
July 23, .	Bureau of Fisheries consignment.	Gloucester, . .	Massachusetts Bay,	175,000
July 26, .	Bureau of Fisheries consignment.	Manchester, . .	Massachusetts Bay,	75,000
Total, .				20,375,000

Collection of Egg-bearing Lobsters by the Massachusetts Fish and Game Commission for the Year 1906.

COLLECTOR.	Number.
Launch "Egret,"	3,382
George W. Bloomer,	1,069
E. F. Locke (Woods Hole),	410
E. B. Mecarta,	5
Total,	4,866

Statement of Lobsters sold to United States Bureau of Fisheries, at Stations at Gloucester and Woods Hole, in 1906.

KIND.	WOODS HOLE.		GLOUCESTER.	
	Number.	Value.	Number.	Value.
Brown egg,	728	\$202 40	74	\$22 35
Green egg,	427	141 55	-	-
Totals,	1,155	\$343 95	74	\$22 35

DATE.	Amounts returned to Treasurer of the Commonwealth.	DATE.	Amounts returned to Treasurer of the Commonwealth.
July 3, 1906,	\$117 50	Aug. 20, 1906, . . .	\$1 40
July 19, 1906, . . .	19 65	Jan. 30, 1907, . . .	141 55
Aug. 2, 1906,	85 90		\$366 00

BOSTON, MASS., Dec. 16, 1906.

GEORGE W. FIELD, *Chairman, Boston, Mass.*

DEAR SIR:—In the launch "Egret" we have collected this year 3,381 seed lobsters. They were disposed of in the following manner: 318 brown-egg lobsters were shipped to Woods Hole; 74 taken to the Gloucester hatchery; 427 green-egg lobsters to Woods Hole hatchery; 2,497 green-egg lobsters liberated. In the handling of these lobsters 11 died; 78 were caught and paid for twice and 2 were caught and paid for three times; 256 were less than 10½ inches in length. We have received and distributed 5,300,000 from the Woods Hole hatchery and 4,000,000 from the Gloucester hatchery of the fry from the lobsters that have been

sent to them from the "Egret." This fry was let go as nearly as possible in the locality and in quantities proportional to the number of lobsters there taken. We have also liberated 703 adult lobsters from the Gloucester hatchery, but all which we have sent to the Woods Hole hatchery have been liberated in that region.

In doing this work the "Egret" has run 4,623 miles, at an average rate of 10 miles an hour. We have had no accident whatever, and have not been delayed by either the boat or machinery during the summer. This summer has been very foggy, and in the latter part there was a month in which there were very few days in which the fishermen could fish; their traps were stove up, and it was such bad weather that it was nearly impossible for them to get out at all.

By the strict enforcement of the Sunday gunning law, shooting from boats is practically stopped on the coast where we can reach it with the "Egret." In general the weather on Sundays during this fall has not been good for gunning.

In the spring of the year we were employed somewhat in the propagation of the shellfish, as the United States government boat was collecting most of the lobsters on the north shore. We have got a great many more lobsters on the south shore than on the north. The well in the "Egret" has not been opened this year, as we find that we will not have near so many dead lobsters by running them dry as we had when we used an open well. This we have faithfully tried. There are very few repairs needed on the "Egret" this year, aside from the painting and varnishing. In Cohasset it would help us to get many more lobsters if they could be collected by some one there, so that when we go there I could get them from one man. It is a harbor that we cannot get in and out of unless it is half tide or better, and it is seldom that I can wait to see all the fishermen and get out in less than twelve hours.

Yours respectfully,

B. A. FOSTER.

Lobster Meat.—There is still urgent need of a law, both from the point of view of the public health and of the lobster fishery in this State, which will effectually eliminate the practice of selling "lobster meat" at wholesale, and of lobster meat prepared at any considerable distance from the point of consumption, or prepared under unsanitary conditions.

The following is a correct statement of the state of affairs under our present laws, not alone on the Maine coast, but along the Massachusetts shore as well:—

A lobster pirate is making a good revenue in the waters of Maine by buying short lobsters at 2 cents each from the fishermen, and boil-

ing them on a steam launch which he has fitted with a boiler. He breaks the tails and claws from the lobsters, and has nothing to fear from the fish and game wardens, for there is no evidence to convict him. He can handle 800 pounds of meat per day, which he sells in Boston, obtaining good prices from the hotels and restaurants. He contemplates buying three more launches this summer.

Even the fisheries which attempt to furnish substitutes for our lobsters are already having "troubles of their own," as the following clippings show: —

The crawfish season has opened again in California, and the first catches of the year were brought in from the islands the first part of the month. Prospects are not very bright for the fishermen who make a specialty of this line of trade, for the prices are low and the fish are scarce. The wholesale and retail prices are usually quite high at the opening of the season, when there is as a rule a big demand for the fish; but this year the opposite is the case, — the wholesale price has been several points lower than it was last year. The lawful season commenced September 15. The average number of men to a camp is three, and it is estimated that there are at least fifty camps between San Diego and Santa Barbara. The great majority of these camps are on the different islands of Santa Rosa, Santa Cruz, Santa Barbara, Catalina, Anacapa and San Clemente, all lying at a short distance to the westward of the southern California coast. As off any high and rocky promontory is a good place for taking them, the mainland will also have many traps close to it, but the islands are better for good money making. The work, if pressed hard enough, is a profitable one, many men making as high as \$20 per day out of it. It is highly dangerous, as the traps usually have to be visited before it is light in the morning, and often when the seas are rough. A skiff must be used to get to them, and it is only the most able oarsmen and intrepid seamen who can stand it. If the traps are not visited every day, there is a loss of that day's labor entire. ("Pacific Fisherman.")

The "Fishing Gazette" of June 2, 1906, says: —

The fish and game merchants of New Orleans, La., held a meeting last week to protest against a proposed law to restrict the shrimp-fishing season. They claim it will be the means of seriously embarrassing many of the fish merchants, and will also deprive thousands of poor men from making a living. They also claim it is absurd to have a close season on shrimp, for they spawn at all times of the year.

INLAND FISHERIES.

Stocking State Waters with Food Fish. — The practice of maintaining and protecting at public expense the fisheries of the public waters is of long standing, and is firmly established in well-nigh all densely populated States and countries as both expedient and profitable. Two definite methods are in vogue: —

I. The regulation of fishing for the purpose of protecting the adults either (1) during the breeding season, or (2) in cases where the demand exceeds the natural increase: (*a*) by reducing the number of fish taken during the year; (*b*) by limiting the catch; (*c*) by limiting the number of days upon which fish may legally be taken, *i.e.*, a close season; or (*d*) by prescribing how and by what apparatus fish may or may not be taken.

II. The artificial hatching and rearing of young fish, and subsequent stocking of the water by the liberation of fry just hatched, or preferably one or two year old fish.

The purpose for which such laws are instituted is absolutely correct. If the adults of both sexes are not protected, the number of fertile eggs laid is immediately reduced. Then necessarily follows a decrease in the number of young hatched, and a proportionally smaller number of immature fish. Observations indicate that in a natural trout brook, undisturbed by man, an optimum population of all classes of life is established; enough insect larvæ, adult insects, worms, crustacea and small fish of various species are present to furnish food for a rather constant number of young trout. Further, practically enough large adult trout are present to eat at least 90 per cent. of the trout fry before these young reach the breeding age, and to furnish a number of offspring practically just sufficient to furnish food for themselves and similar large fish. Thus a surplus of not more than a pair or two come to maturity out of the hundreds of annual progeny of each pair of breeding fish, to replace the old trout which pass on through accident or senile decline.

When, however, man appears, and a considerable number of the breeding fish are removed by him, the most important consequence is a sudden diminution of the number of eggs laid and a corresponding diminution in the number of fry hatched; consequently, a relatively larger proportion of young fish which are

destined to go as food for the "big fellows." A 2-pound trout, for example, requires a certain weight of animal food per day. He will persistently hunt until this amount is secured and his voracious appetite is satisfied. If, then, only a relatively small number of young trout are present, it is possible that every one of these may thus fall victims, and not alone an actually smaller number but even no surplus fry may remain to grow to become breeding adults. When this occurs, the trout fishery in that brook declines, and the waters soon become occupied by less valuable fish; or else the stream remains unproductive, yielding either nothing to man, or at least less than its normal productive capacity. Such is the history and condition of most of the unpolluted waters of Massachusetts, chiefly from a failure to maintain unimpaired the number of breeding adults.

The necessity of meeting these conditions has led to biological studies which prove the following facts of economic importance: —

(1) More trout fry can be secured by artificial impregnation of the egg than are ordinarily hatched under natural conditions.

(2) The trout fry can be reared artificially in immense numbers with less mortality than in nature.

(3) By an increased quantity of food the rapidity of growth may be accelerated, and by substitution of an artificial food in place of young fish a greater weight of trout may be secured at less expense. Whereas nature feeds calves with whole milk and trout with smaller trout, man secures equal results at less cost by substituting foods of other less valuable materials.

(4) More satisfactory economic results may be obtained by continuing the artificial feeding and rearing to an age limit not yet very definitely determined, but which is at least at or near the age of sexual maturity (two years in the case of brook trout), than by liberating the fry at an earlier stage. The obvious advantage of this method of stocking our waters is found in the fact that the larger the fish are at the time of liberation, the smaller is the number that fall a prey to the voracious adults. Hence stocking with fingerlings, *i.e.*, trout one year old, has proved more satisfactory and economical than stocking with fry, *i.e.*, just-hatched fish, or, more exactly, fish which have just begun to feed actively. Similarly, and such is the testimony of

the Maine commissioners, it is to be expected that two-year-old fish would yield better results for stocking than would younger fish.

The Number necessary for Stocking. — The question of the proper number to liberate in a stream at the time of stocking demands a consideration of several points: (1) the amount of food, (2) the minimum volume of water in times of drought, and (3) the number of fishermen resorting to those waters. In general, a large number of fish can be reared and transported relatively cheaper than a small number, and the chance of success is manifolded if the number is adequate. In too many cases we are obliged to make plants by liberating the young when the number of fish available is so small that it is probable that all the fry or fingerlings are eaten by larger fish, leaving no surplus to become established as breeders. Often an additional 100, 500 or 1,000 fingerlings in a brook or a pond would satisfy the demands of the larger fish, and leave an adequate surplus. This may cause one to question the practicability of any stocking of the water whatever; but we should note that nature does the work in this very way, producing what appears to be excessive numbers of young, very few of which ever attain maturity. The best modern methods are close to nature's own practices, and in general merely seek to hasten and to strengthen her processes.

Since our State hatcheries were established, great changes have come in the methods and possibilities of trout propagation. Formerly, there were no commercial hatcheries; the State hatcheries were almost the only available source of trout fry. Fingerlings were rarely, if ever, used for stocking purposes. When it had been demonstrated that trout could be artificially propagated on a profitable commercial basis, many commercial plants developed. From the fact that such an establishment can sell its surplus adult fish at rarely less than 50 cents per pound, also a considerable proportion of the surplus eggs, fry and fingerlings, and that usually the proprietor or manager does the most important work himself (working sometimes twelve or more hours per day when necessary), or personally supervises unskilled laborers, the actual net cost per thousand fish is considerably less than when done at a State hatchery, where both skilled and unskilled labor must be paid maximum wages, and for eight hours' work.

In spite of this, we believe that the State should maintain its own hatcheries, (1) not alone for the purpose of maintaining its independence of combinations of the commercial hatcheries to secure unduly high prices, but (2) particularly for the purpose of advancing our knowledge of *diseases* of both young and old fish, (3) of devising methods of handling and feeding such fish of all ages and conditions, (4) of determining the effects upon food fish of sewage and other pollutions and upon the possible sanitary problems related thereto, and (5) of making trials of new species and of developing improved breeds. Such a hatchery, however, should in all its features be a model, not alone for the economical propagation and distribution of food fish, but also adapted for accurate studies of all the problems connected therewith. With increasing population and the higher prices for all nitrogenous foods, the questions of securing the best possible yields from the water as well as from the land will become of ever greater importance. We are more and more convinced that such a plant, adapted for rearing not less than 250,000 fingerlings annually, should be established at the earliest possible date.

Though we believe firmly that the brook trout is the fish par excellence for our streams, there is much other public water for which this fish is not adapted. To a limited extent we have distributed in certain of our waters and have made observations upon the rainbow (*Salmo irideus*), the European or brown trout (*Trutta fario*) and the landlocked salmon (*Salmo Sebago*). When it was learned that trout fingerlings could not be satisfactorily reared at the Hadley hatchery (compare reports for 1903 and 1904), we considered the propagation of black bass or white perch or the large catfishes. With the loss of the surface water, however, this cannot be undertaken with probability of success, though the value of the hatchery building and the supply of ground water for hatching eggs continues thus far apparently unimpaired.

The Distribution of Game Fish. — From the State hatcheries during the past year 815,000 fry, 60,450 fingerlings, 500 two-year-old fish and 296 large fish, all of the salmon family, were distributed to public brooks and lakes. (For details, see Appendix B.)

The Hadley hatchery has invariably yielded us larger and stronger trout fry than either the Winchester, Sutton or Adams hatcheries. (See reports for 1903 and 1904.) The Hadley hatchery was established at a time when it was generally believed that trout streams could be most satisfactorily maintained by stocking with fry. It was built solely as a hatching station, from which the fry were to be distributed soon after hatching. The abundant supply of ground water of unsurpassed quality was found to be well adapted for hatching the eggs, and this station has every year since its establishment furnished our best stock of fry. The water of Hart's Brook, running through the hatchery grounds, furnished water to the pond and pens in which the stock of approximately 2,000 brood fish was kept. When it became evident that stocking with fingerlings gives more certain results than when done with fry, attempts were made to rear fingerlings at Hadley by using the water from driven wells, supplemented by water from Hart's Brook. The results, however, were unsatisfactory, mainly on account of insufficient flow of water to maintain a low temperature. There always, however, was sufficient water to maintain the brood fish in good condition without unusual mortality.

In the summer of 1905, however, the town of Hadley constructed a reservoir which impounded the water upon the upper watershed of Hart's Brook and diverted it to the town mains. This diversion of the water, while not apparent during the fall, winter and spring rains, so reduces the supply to the pond during the summer months that it is no longer advisable to risk keeping a brood stock of fish in the pond, from which to secure a supply of eggs for the hatchery. It also precludes the utilization of this pond for rearing black bass, white perch or other valuable food and game fish. The brood fish, therefore, were transferred to the Sutton hatchery, and the eggs must hereafter be transported annually from Sutton to Hadley. This greatly lessens the value of the hatchery property. We are of the opinion that the damage to this property by thus diverting the water is not less than \$1,000. When a personal conference and a view of the premises with the water commissioners of the town of Hadley failed to bring about a satisfactory adjustment, the matter was referred to the Attorney-General of the Com-

monwealth, for the purpose of protecting the interests of the State.

Report of the Sutton Hatchery. — That portion of the report of Arthur Merrill, superintendent of the State hatchery at Sutton, which pertains to the hatching, rearing and distribution of game and food fish, follows: —

The fry hatched from the eggs collected the previous season numbered 400,000; of these, 35,000 were brown trout and 4,000 were land-locked salmon. The additions to this number before or during the hatching season amounted to 60,000: (1) 30,000 brook and rainbow trout received from Hadley; (2) 20,000 salmon hatched from eggs received from the United States Bureau of Fisheries, Grand Lake Station, Me.; and (3) 10,000 rainbow trout hatched from a lot of 25,000 also received from the United States Bureau of Fisheries, from Manchester, Ia. There were 275,000 fry distributed in April and May. The remainder, minus some losses from disease, were reserved for rearing, — a smaller stock than usual, but yielding a better lot of fingerlings than the previous three years. The salmon and rainbow trout were much reduced by disease, which attacked those in the pens and tubs below the dam. The fry brought from Hadley suffered much loss from inflammation of the gills, due to irritation from transporting them in warm weather. During the season for distribution some loss of fingerlings was experienced in the lower tubs, where they were held awaiting shipment, owing in part to inflammation of the gills in those that were caught from muddy ponds, and in part to the poor water supplied to the lower tubs, which is unfit for use at any season.

The hatching was very satisfactory, except for the lateness of the last lot of eggs. This, as in former years, delayed the distribution of the fry and gave less satisfactory results, since it was necessary to use the late fry in stocking our rearing pens and tubs. In the case of the salmon and rainbow trout, where losses have been frequent following the removal from the hatchery to the lower tubs and ponds, it is very probable that these losses are due to the change to the outside water, when it has become much higher and more variable in temperature than the hatchery water. If the hatching could be done earlier, the fry could be established in summer quarters, and be so far developed as to stand better the summer temperature.

The brood stock, which had become seriously depleted, was considerably increased by the addition of a portion of the Hadley stock; and an increase of eggs resulted during the present season, even though the average size of the fish was smaller. The decrease in the size of the breeders has continued for several years, and doubtless new stock is required to regain the lost ground in that respect. The work of improvement being mostly directed to quail and pens for the northern

varying hare, commonly known as the "white rabbit," not much could be done on the ponds; but all the shallow exposed ponds except one were covered with netting and shaded, and, although stocked much more lightly than commonly, yielded an increased number of fish of a very much larger size, the one unprotected pond alone showing a decrease in the number of fish raised.

One unused plank pen below the dam was made secure, and an excellent lot of salmon raised there. The leakage which made the pens useless for fingerlings was stopped by tearing out the board bottoms. Underneath the board bottom a solid pavement of cobblestones was found; and, by using this for a foundation, a cement bottom could be put in, making the pens safe and useful at all seasons. The next season the other pen will be put in order, and the two will doubtless carry through a lot of salmon as large as those lost this year in the lower tubs.

The work of improving the ponds should be continued, and several available locations should be utilized for building new ponds, as the surest and quickest way of making a further increase in the output of fingerlings. There still is a question as to what extent the water supply can be burdened with additional stock; but it seems unlikely that the four additional ponds proposed will cause any harmful deterioration of the water, especially if some of the worn-out tubs are discontinued, which seems desirable, as the small and inferior tub fish are often a cause of dissatisfaction when distributed.

The work of improving the grounds and buildings was continued to some extent, the ice and meat houses removed, considerable brush cut away, fencing completed and gates hung. Many heaps of rocks that had accumulated in previous work on the grounds were removed, incidentally to the work done on quail pens.

The usual recommendations for repairs and additional work are made, and it seems well to urge that this matter be given special attention, and that before any further work is done the subject be carefully studied, and a plan adopted looking to a rearrangement of many features of the hatchery, in order to avoid many serious faults and to handle the stock more effectively. The many extensive repairs that have been made have perpetuated these defects at a cost greater than the desired changes, and the added cost of doing the work with the depreciated value of the output represents a still greater amount.

The hatchery building will in the near future require such extensive repairs that it is a question if it would not be better to rebuild it in another location, and gain thereby a great advantage in handling the fish; also, to make it useful for many purposes for which it is at present unfit. Its location is 500 feet from the springs that supply it, and two lines of pipe carry the water supply for it and the stand of tubs near by. The pipe that supplies the tubs is so nearly clogged with rust as to be useless; the water supply that it carries is too scanty for any considerable number of fish. As has been frequently noted in

the reports, the hatching is very late, and when the fry are distributed or put into the rearing ponds they are poorly developed and often decidedly inferior. The lateness of hatching is certainly due to the distance to which the water for the hatchery is carried, permitting it to cool in the long flow through the pipes. Moreover, it is probable that the fry are weakened because of the late hatching and the deterioration of the water. This is indicated by occasional losses in the hatchery troughs late in the spring; and, while a comparison of the results from using the water at the hatchery and at points near the springs cannot be made, because none of the hatching has been done at the springs; the contrast between the water used for rearing the fish and that for shipping the fish is very marked. Disease has repeatedly destroyed the fry and fingerlings kept at the hatchery, but when kept elsewhere, though in water drawn from the same source, the fish have suffered no harm.

The relocation of the hatchery at this time is suggested, since the present building is so far decayed that its future use is not possible without extensive repairs. In the mean time, if this plan is adopted, further repairs can be made to conform to it, and in the end much of the inconvenience arising from the scattered and unrelated places avoided. The spawning would in this case be done at the hatchery, and not as at present, at a distant point without shelter. The work in connection with shipping fish, which is done without any conveniences for handling fish or protection in inclement weather, could be done from the hatchery, using tanks that have a good water supply, instead of the treacherous supply used at present.

For the better control of the visitors at the hatchery and the protection of the property and stock, now too widely scattered to be closely watched, fences should be built, dividing the grounds into parts, so that no one unless authorized can get near the breeding stock or the hens that are setting on pheasants' and quails' eggs, or the incubators and brooders, or the remote parts of the grounds where opportunity is offered for mischief. The pens are now constructed so that the connecting fences would involve only a small outlay, and, besides serving the purpose mentioned, would form convenient lines for planting trees, etc., and would serve in the building of temporary pens that are needed for holding birds to be distributed.

The eight-hour law, which went into effect during the summer, will require a somewhat different arrangement for doing the routine work, which has usually been done with the aid of one man. As this work at some seasons requires a fifteen-hour day, it will be difficult to do it properly with the former arrangement. At other seasons, when it does not require the full time to do the routine work, several hours each day have been devoted to permanent improvements and repairs. In this respect, much is accomplished in the course of the year. Because of this law, the work for permanent improvements and repairs must in the future be done by extra help, and it can not be left undone.

The agricultural papers of this country are unfortunately accustomed to look upon the fish and game laws, and the activities incidental thereto, as being undertaken solely in the interest of the "sportsmen." Such papers, perhaps unintentionally, oftentimes do much to establish such a misconception. No one class of people are so directly and so extensively benefited by the fish and game laws as is the farmer. In Europe, agricultural societies directly promote the propagation of fish and birds.

The "Fishing Gazette" for Jan. 5, 1907, says:—

What is reported to be the largest fish hatchery in the world is in the course of construction in Smaland, Sweden. Several local agricultural societies are behind the movement. A morass of about 30 acres has been secured, and this tract will provide a place for 60 basins. The land lies so that the expense of dams and other works will be comparatively light. It is planned to propagate not only fish from Sweden, but spawn will be obtained from Germany, Hungary, Italy and the United States. An expert from Germany will have charge of the hatchery.

Effect of Fish upon the Purity of Water.—We have frequent requests from water commissions and owners of artificial lakes for information as to the effects of fish of various species upon the purity of the waters. Some of the general results of our investigations are given in the following reports. Other reports of a similar nature have been made from time to time.

BOSTON, MASS., May 31, 1906.

A. E. PICKUP, Esq., *Registrar, Board of Water Commissioners, City Hall, Holyoke, Mass.*

DEAR SIR:—In reply to yours of April 25, and as a result of our visit on May 15, we are sending you herewith a report with recommendations in regard to stocking the high-service reservoir with food or game fish.

If you decide that it is expedient to put in game fish, any species of trout could be used. If you wish a fish which is an edible fish, and yet not strictly a game fish, I would suggest white perch. In any event, we would not advise the introduction of bass or pickerel, for the reason that a better quality of fish can be satisfactorily maintained there. We would warn especially against the introduction of carp of any species.

Yours very truly,

GEORGE W. FIELD,

Chairman.

MAY 31, 1906.

A. E. PICKUP, Esq., *Registrar, Board of Water Commissioners, City Hall, Holyoke, Mass.*

DEAR SIR:—In accordance with your request of April 25, we personally visited, on May 15, the Holyoke high-service reservoir, for the purpose of securing information upon which to base the recommendations which you ask.

At the city hall we examined the contour and section maps of the reservoir, to ascertain the depth and the general course of the water currents.

We drove around the reservoir, and noted the characteristics of the water-shed and of the bottom of the reservoir. So far as we could observe, everything was in good condition, and the prospects are excellent for a continuance of the very satisfactory biological conditions.

The chief question at issue is, however, one which you, not we, must decide. To what extent do you wish game fish, *i.e.*, carnivorous fish, to be maintained in the reservoir? Under natural conditions, game fish are relatively few in numbers when compared with the smaller vegetable-eating animals (small fish, snails, clams, insect larvæ, etc.).

The ideal condition to which nature would attain in a long period of years, if left undisturbed by man, would be an exact balance between the total intake and the total outgo of the animal and vegetable organisms in the water. In such a state of biological equilibrium the vegetable growth is just sufficient to pasture the vegetable-eating organisms, and the carnivorous animals are exactly numerous enough to prevent an undue increase of the vegetable eaters. The excreta of the animals, and plants, together with the material resulting from the decay of the dead bodies, furnish the proper quantity of plant food to keep the pasturage in condition. Thus the cycle of matter goes on, and the equilibrium is maintained by natural causes. Such conditions obtain in isolated lakes in the virgin forest, where the best drinking water is found. Similar conditions may be artificially produced in a glass jar of water, when by experimentation under proper conditions the quantities of animal and vegetable may be so adjusted as to exactly compensate each other, — “a balanced aquarium.”

The causes which bring about the undesirable biological conditions evidenced in offensive odors and tastes in the drinking water are at least two-fold, and both traceable to human activities. First, the destruction of trees and vegetation on the water-shed increases the quantities of nitrites and nitrates, and other nitrogenous materials, which enter the pond with the storm and ground water. In instances where tracts upon the water-shed are cultivated, this increase may be still greater. In certain reservoirs where the basin has not been “stripped” before flooding, the growth of vegetation may become excessive for the similar reason that the larger quantities of chemical plant food bring about more extensive and rapid growth of plants in the water. These

growths may be inoffensive, and act as beneficent agents in improving the potable qualities of the water. On the contrary, some species may in their growth store up certain essential oils (analogous to that of the mint and other well-known plants), which, upon the decay of the plant and the liberation of the oil, may cause the water to become decidedly malodorous. The fishy taste of pond water comes not from the fish, but from such oil-containing microscopic plants which have multiplied beyond all natural bounds. Such organisms as *Anabæna*, *Clathrocystis*, *Uroglena*, *Synura* and others that are particularly offensive and frequent, are in general the causes of the bad odors and tastes.

One cause of this unnatural preponderance has been referred to above, viz., the denudation of the water-shed, which leads to a superabundance of food and consequently to an abnormal growth of aquatic vegetation, most frequently microscopic. The second cause is the unnatural decrease of the organisms which devour this microscopic vegetation. Such organisms as snails, clams, water fleas and other small crustacea, insect larvæ, including the young of the mosquito (note that the young mosquito is directly beneficial, but the good die young!) and fish fry, feed almost exclusively upon these microscopic plants. Thus a certain number of such animals must be maintained, to keep the undesirable microscopic plants eaten down to a degree where the presence of these latter is not offensive.

From the above we must infer that the first move to improve the quality of a potable water which is periodically or continuously below the optimum on account of the presence of these undesirable plants would be (1) to control the denudation of the water-shed, and (2) to increase the number of snails, clams, crustacea and plant-eating fishes, etc., in the water.

The number of these latter animals can be most easily augmented by preventing the increase of their enemies; the fewer carnivorous fish, the more small fish, snails, crustacea and insect larvæ, and, as a result, a corresponding diminution of the offensive micro-organisms. These biological facts point to the conclusion that the indiscriminate stocking of reservoirs of potable water with game fish is, on general terms, and for these reasons, unwise. In the personal opinion of the writer, stocking with the European carp may be still more unsatisfactory, and is not to be undertaken without careful study of the special conditions.

A chief objection to the employment of copper sulphate for purifying reservoirs may be the fact that it may totally annihilate all the beneficent organisms, such as snails, clams, crustacea, insect larvæ, etc., which normally control the biological equilibrium, and fails to remove the *real causes* of the annual plague of offensive microscopic vegetation.

While, however, it may be true that game fish, *e.g.*, of the trout, bass and pickerel groups, may be undesirable inhabitants of reservoirs, and certainly should be removed from such reservoirs where the biological examinations indicate a tendency to abnormal increase of *Anabæna*, *Clathrocystis*, *Uroglena* and *Synura*, in many cases it may be

desirable to permit the growth of such game fish, which, when mature, could be removed under proper control and supervision. Under the ordinary conditions, if the growth of the carnivorous fish were not found to impair the quality of the water, the catching of the large fish either for sport or for economic uses, if done in an approved manner, would not do injury.

Briefly, then, in general where the quality of the water is excellent and the condition of the water-shed as well controlled as in the present case, game fish may be maintained in limited numbers with little danger of impairing the quality of the water; but careful observations should be maintained of the number of organisms shown by your biological analyses, and a gradual increase approximating to a degree where offensive conditions may be caused, should be met by diminishing the number of carnivorous fish, and of increasing the number of fresh water clams, snails and crustacea, and small herbivorous fish.

Should you so desire, the writer will gladly confer with your board, and give more specific suggestions upon the matter of the biological analyses now being carried on.

Yours very truly,

GEORGE W. FIELD,
Chairman.

Brook Trout Fishing. — Evidence of satisfactory and improved brook trout fishing comes from various sections of the State: —

WARE, MASS., Dec. 17, 1906.

Dr. GEORGE W. FIELD, *Boston, Mass.*

DEAR SIR: — Enclosed find a list of some of the trout that were caught in this section last season.

Homer Beach of Ware caught 24 trout in one day, weighing from 3 ounces to $1\frac{1}{4}$ pounds; another day, with friend, they caught 31.

Thomas F. Horrigan of Brighton caught 38 trout in one day, weighing 14 pounds, the largest one weighing 2 pounds.

J. H. Dunphy of South Hadley Falls, and myself, caught 29 trout in seven hours, weighing $16\frac{1}{2}$ pounds. Those fish were all taken within five miles of Ware, and they are all open brooks. I will enclose Mr. Marland's letter, which speaks for itself.

Respectfully yours,

DENNIS F. SHEA.

WARE, MASS., Dec. 13, 1906.

DEAR SIR: — The report you requested is as follows: June 8, 11 trout, averaging 8 to 10 inches; June 15, 9 trout, averaging 8 to 10 inches; June 22, 23 trout, averaging 8 to 10 inches; June 29, 18 trout, averaging 8 to 10 inches; July 4, 19 trout, weighing 17 pounds; July 7, 14 trout, weighing 15 pounds; July 11, 5 trout, weighing 6 pounds. These are my best catches; the others are not worth mentioning.

Yours truly,

JOHN L. MARLAND.

A Change of Regulations of Fishing in Stocked Ponds. —

In the ponds which were stocked this year, namely, Attitash, in Amesbury; Spectacle, in Littleton and Ayer; Hardwick, in Hardwick; Nuttings, in Billerica; Moores, in Warwick; Tispaquin, in Middleborough; Congamond, in Southwick; Little Alum, in Brimfield; Forge, in Westford and Littleton; Wachusett, in Princeton; Fresh, in Orleans; Dennis, in Yarmouth; Spectacle, in Sandwich; Crane, in West Stockbridge; Mud, in West Stockbridge; Fort Meadow, in Marlborough; Pearl, in Wrentham; Archers, in Wrentham; Hampton, in Westfield and Southampton; Pottapaug, in Dana; Keyes, in Westford; Bloody, in Plymouth; Pratt, in Upton; and Benton, in Otis, — fishing is permitted every day except Sunday from June 1 to November 1, instead of only on Mondays, Wednesdays and Saturdays.

Sunday Fishing Laws. — Since there still persists in the public mind a lack of knowledge of the laws pertaining to fishing on Sundays, we may repeat that fishing on the Sabbath is a violation of the Sunday laws, but not a violation of the fish and game laws unless the fishing is done on a closed pond. In the latter case, the law against fishing in closed season (though it be on a Sunday) is enforced by our deputies, but they have no authority to enforce the general Sunday laws which forbid fishing on the Lord's Day; the enforcement of these laws is in the hands of the local town authorities.

Destruction of Inland Food and Game Fisheries by Pollution of the Brooks and Rivers. — As an important feature in the solution of the question how to check the excessive flow of population from country to city, increased consideration must soon be given by the State to the amelioration of country conditions. Among the most important of the conditions which render the country less attractive to the visitor and to the commuter, and of diminishing productive capacity to the farmer and the country resident, is the ever-increasing and frequently unnecessary pollution of our streams and rivers by the so-called waste products and sewage of manufactories: sawdust and shavings from wood-working mills; wool scourings, dye stuffs, acids, etc., from cotton and woolen mills; tarry wastes from gas works; copper and iron salts from tack and nail factories; local "dumps;" stable, house, town and city sewage. Nearly all of these materials are

of greater or less commercial value, either as a source of certain specific substances or as irrigating or fertilizing material. In the great majority of cases this value is not sufficient to warrant in their utilization the diversion of capital which can be more profitably employed. In many instances, however, the damage to public and private property or to public resources (the inland fisheries and the shellfisheries) are so manifest and so extensive that the public is warranted in compelling the disposal of this material in such a manner that the injury is minimized. In many instances, if this material was pronounced to be a public nuisance, the attention necessary to secure a satisfactory and economic disposal of such wastes would be developed. Such is the fact in the instance of sawdust, which previous to 1890 was permitted to enter the streams, to the great detriment of the trout and salmon fisheries. Since 1890, uses for sawdust have been devised, so that, except in instances rare in Massachusetts, the sale of sawdust and planer shavings has been a considerable source of income to the sawmill owners, as well as of value to the farmer in stopping an important "leak" on the farm by absorbing the liquid barn manures and as a cheap and satisfactory bedding for stock. Thus the economic effects of the law prohibiting the pollution of public water ways by sawdust has not alone contributed to maintaining the trout in the streams, for the benefit of the country visitor and the country dweller, but has changed an economic loss to the mill owner to a source of profit to him and to the farmer, and through these to the entire community.

In a similar way, the time is not far distant when the quantities of other waste substances polluting public waterways will be such a conspicuous injury to the inland fisheries and to the shellfisheries in the harbors and estuaries, and also the quantities of material will be so considerable, that economic considerations will lead to the utilization of such waste material for fertilizing and irrigating farm land. Abundant experiments prove that such wastes are quickest rendered harmless to health and suitable for plant food when the processes of oxidation and nitrification take place on land. In the longer-settled communities of England, Ireland, Scotland and Germany such materials are utilized on land very completely for the benefit of agriculture

and the maintenance of excellent trout and salmon fisheries. Increased intelligent attention to these questions should be given by our legislators.

It is unnecessary to quote more than one or two of the numerous specific instances of fish killed or driven out of streams by pollution of various kinds and degrees. On Oct. 5, 1906, Mr. William H. Larkin of 16 Newton Street, Faneuil, Brighton district, reported (by telephone) that he saw large numbers of dead smelt that morning at low tide along the bank of the Charles River, at the bridge near the Faneuil railroad station. The London "Mail" says: —

An enormous quantity of dead fish has been floating down the River Sow from Norton bridge through the town of Stafford for the past week, as a result of creosote having got into the river at Norton bridge. One man estimates that he has removed three hundredweight of dead fish from the river, and it is believed that for six or eight miles the Sow has been depleted of fish. It is stated that it will take about fifteen years to repair the loss, which is much deplored by anglers.

These conditions obtain very generally, and are to be deplored.

The Sawdust Law. — Since the passage of the law in 1890 owners of sawmills have been prohibited from emptying the sawdust into the streams. Though the law provided for no hearing of aggrieved parties, and that the action of the commissioners was final and not reviewable in the courts, nevertheless, in no case has a hearing been refused except in one instance at New Marlborough, where the hearing was not asked for until nearly a year after this Board had issued the order of prohibition. When it was found that this owner had persisted in violating the order, court summonses were issued. Not until after these court summonses indicated the intention of the commissioners to enforce the order was a hearing asked for. The commissioners were of the opinion that, if a hearing had been desired, it should have been asked for previous to the court summons.

Much time and money was spent in a fruitless attempt to organize opposition and to disseminate misinformation as to the purposes of the commissioners in refusing to make an exception of the sawdust pollution on the Konkapot River. It is scarcely necessary to say that the commissioners regard it to be their duty to consider fully the relative value of the fisheries and of

the industries whence pollution arises. In the very great majority of cases the prohibition of the dumping of sawdust into the streams has led, as previously stated, to the utilization of the sawdust so as to become a source of profit to the mill owners as well as to the farmers who use it. In a general consideration of the problems, it is an open question whether such a stream as the Konkapot River and its tributaries would not have yielded more wealth to the State through an annual crop of fish, if its fisheries had been cherished and maintained from the settlement of the country to the present day, than has been the aggregate value of the water power derived from it during this period. It is, however, certain that, were it not for the tons upon tons of decaying sawdust, the river could be made to pay a larger tribute in trout and in healthful recreation to fishermen and health seekers, and in corresponding prosperity to the residents both in villages and on farms. The sympathies of the commissioners have ever gone forth to those who toil, for we are of them, and so long as we are entrusted with the enforcement of State laws we shall strive to ascertain and to carry out impartially the purposes of the people who made these laws. No one who properly grasps the entire problem can justly claim that the enforcement of the sawdust laws is a contest of "Sport *versus* Industry;" neither is this particular case "one of many" who suffer hardship from this law; nor does it affect the country districts unfavorably, as a writer claimed in many newspapers. The commissioners have ever been desirous of securing fair and frank consideration and discussion for all problems where interests conflict, and in that spirit welcomed the incorporation of the right of a public hearing and of an appeal to the courts or parties aggrieved by the orders of the commission. Since the case has proved useful in defining the respective rights of the mill owners and of the State, the decision of the Supreme Court of Massachusetts is here reprinted.

COMMONWEALTH *v.* SISSON *et al.*

BERKSHIRE.

OCT. 17, 1905.

Water and Water Rights — Pollution of Stream.

LORING, J. — These are two complaints, one against each defendant, charging them severally with permitting sawdust to be discharged into the Konkapot River, on March 29, 1905, in violation of an order made

by the Fish and Game Commissioners, under Revised Laws, chapter 91, section 8, dated Aug. 1, 1904.

The order, after reciting the authority given by the act, and stating that the mill here in question owned by the defendants had been examined by the Board and that it had been determined by the Board that the fish in the brook are of sufficient value to warrant the prohibition of the discharge of sawdust into it, and that the discharge of sawdust from the defendants' mill into said brook materially injures the fish therein, directs the defendants (1) to erect a blower or take other means approved by the commissioners to prevent the discharge of sawdust from said mill into said brook directly or indirectly, and (2) not to accumulate a pile of sawdust on the bank of the brook, so that it may be liable to fall into the stream or be swept away by a rise of water.

At the trial it was proved that this order was served on the defendants on or before July 1, 1904, and that the defendants continued to discharge sawdust into Konkapot River up to the time these complaints were instituted. It also appeared that there were edible fish in the river at the time the Board passed the order in question.

The defendant offered to show in substance that the commissioners in making the order did not act on sworn evidence or personal knowledge as to the fish or the sawdust; that in the spring of 1905 the defendants asked for a hearing which the commissioners denied; that the mill has been used as it is now used for more than thirty years under a claim of right, and that the right was admitted by the next mill owner below; and, finally, that a compliance with the order as to a blower *would impair the efficiency of the mill about twenty-five per cent.; that the sawdust could not be sold, and to cart it away would entirely destroy the value of the land for mill purposes.* This evidence was excluded, and an exception was taken.

The defendant then made the following six requests for rulings, to wit:—

First.—That the act of the Commissioners on Fisheries and Game by which they determine that the fish in any brook or stream are of sufficient value to warrant the prohibition or regulation of the discharge of sawdust from any particular saw mill, or that the amount of sawdust which is discharged from any particular mill materially injures such fish, is a judicial act, which can be lawfully performed only after the hearing of evidence bearing upon the questions involved, viz., the value of the fish in such brook or stream, and the effect of such sawdust as injuring such fish.

Second.—That the order in this case, having been passed by the commissioners without hearing any evidence and without any knowledge by them of the value of the fish in the stream or the amount of water in the stream, or the amount of sawdust that is discharged by defendants' sawmill into the stream, is not a lawful order under the statute, and is not binding upon the defendants.

Third.—That the defendants and the predecessors in title, having been

discharging sawdust from their sawmills for more than twenty years consecutively, under a claim of right, into the Konkapot River, have acquired by prescription a title to such right, and such right is their property, of which they cannot be deprived without compensation.

Fourth.—That section 8 of chapter 91 of the Revised Laws makes no provision for compensation to the owner of a sawmill who is forbidden by an order of the commissioners to discharge sawdust into a brook or stream, and said statute is therefore unconstitutional and void so far as these defendants are concerned.

Fifth.—That this order of the commissioners so interferes with the use of the property of the defendants as to amount to a taking of such property for public use, and the order is void, as no compensation to defendants for such taking is provided by the order or by the statute under which the order is made.

Sixth.—That this order of the commissioners so interferes with the use of the property of the defendants as to seriously damage, impair or injure such property, and the order is void, as no provision is made, either in the order or the statute under which the order is created for compensating the defendants for such damage, impairment or injury to their property.

The defendant's grievance is that by an order of the Board of Fish and Game Commissioners they have been deprived, without compensation being made therefor, of the right to conduct the business of sawing wood as they and their predecessors in title have conducted it for thirty years last past; that from this decision there is no appeal; and that not only was the order made without a hearing, but when a hearing was asked for by the defendants it was denied.

Their contention is: (first) that under the act they had a right to be heard at the trial in the Superior Court on the questions of fact determined by the Board; (second) that they could not be deprived by the Board of their prescriptive right to discharge sawdust into Konkapot River without being heard and by a finding not made on sworn evidence; and (third) that under any circumstances this right cannot be taken without compensation being made therefor.

In support of their contention, they argue that the Board, in determining (1) that the fish in Konkapot River are of sufficient value to warrant the prohibition or regulation of the discharge of sawdust therein, and (2) that the discharge of sawdust from the defendant's mill materially injured such fish, was a judicial action; and in connection with this argument they rely on the distinction pointed out in *Salem v. Eastern Railroad Co.*, 98 Mass. 431, between the action of a local board of health in making general regulations respecting articles capable of conveying infection or creating sickness, and the authority of such a board to examine into the existence of any specific case of nuisance, filth or cause of sickness dangerous to the public health, and to make an order for the removal of it. The former, being a rule for all, is legislative in character; the latter, being a determination as

to a particular thing, resulting in an order to the owner of it to do a specified act, is judicial in character. For a later case, where it is pointed out that similar legislative and judicial powers are given to the State Board of Health in connection with the pollution of a body of water used as a supply of a city or town, see *Nelson v. State Board of Health*, 186 Mass. 330.

We agree with the defendants' counsel as to what the order here in question is not. We agree that it is not a general regulation. What is determined by it is, that the discharge of sawdust from the defendants' mill materially injures the fish in Konkapot River; and it orders the defendants to erect a blower, and forbids the defendants making a pile of sawdust in connection with the mill; and it resulted in an order served on these defendants to do these acts. This is not a general regulation. But we do not agree that, because it is not a general regulation, it is a judicial action. The question to be decided here does not depend upon a choice between the two classes dealt with in *Salem v. Eastern Railroad*, 98 Mass. 431, and in *Nelson v. State Board of Health*, 186 Mass. 330, and for these reasons:—

We are of opinion, in the first place, that it is within the power of the Legislature to protect and preserve edible fish in the rivers and brooks of the Commonwealth, and for that purpose, if they think proper, to forbid any sawdust being discharged into any brook containing such fish.

The right to run a sawmill on the bank of a brook or a river is, like all rights of property, subject to be regulated by the Legislature when the unrestrained exercise of it conflicts with other rights, public or private. (See *Commonwealth v. Alger*, 7 Cush. 53, 54; *Rideout v. Knox*, 148 Mass. 368.) The defendants' contention, that they have a prescriptive right to discharge sawdust into the river (even if it kills or injures the fish therein), which prescriptive right cannot be taken away or impaired without compensation being made therefor, means this, and nothing more: where the Legislature, up to the passage of the act here in question (*St. 1890, c. 129*), had not regulated the business of sawing wood on the banks of streams having in them edible fish, and where, in the absence of such regulation, the defendants had discharged sawdust into the stream for thirty years, the people have lost the power to regulate the conflicting rights of sawmills on the bank of the stream, and to preserve fish in the stream itself. The statement of the proposition is enough to show that there is nothing in it. The decision in *Attorney-General v. Revere Copper Co.*, 152 Mass. 144, relied on by the defendants, is confined to the gaining of prescriptive rights with respect to property owned by the public under a statute of limitations, which puts the property rights of the public on the same basis as those of individuals.

We are of opinion, in the second place, that, in case the Legislature

thought that in regulating the conflicting rights of individuals to run sawmills on the banks of a river on the one hand, and of the public on the other hand to have fish live and increase in the same stream, it was not worth while to forbid sawdust being discharged into every stream in which there were edible fish, they could leave to a board having peculiar knowledge on the subject the selection of the brooks and rivers in which the fish were of sufficient value to warrant the prohibition or regulation of the discharge of sawdust. The right of the Legislature to delegate some legislative functions to State boards was considered by this court in *Brodvine v. Revere*, 182 Mass. 498.

And further, in case the Legislature thought that an act which forbade any sawdust to be discharged into any of the streams selected by the Board was an unnecessarily stringent one, they could, in our opinion, leave it to the Board to settle in each particular case the practical details required to harmonize best these two conflicting rights.

The power thus delegated to the Board, of fitting the details of regulation to the particular circumstances of each case, is of the same character as that long exercised by the Fish and Game Commissioners and their predecessors the Board of Inland Fisheries in prescribing the details of the construction of the fishways to be constructed in dams where by law fish have to be maintained. (See St. 1866, c. 238, §§ 2, 6; St. 1867, c. 344; Pub. Sts., c. 91, § 4; see also Prov. Laws, 1745-46, c. 20, State ed., vol. 3, p. 267.) These acts provide that the Board, after examination of dams upon rivers where the law requires fishways, is to determine whether the fishways in existence are sufficient, and to prescribe by an order in writing what changes or repairs, if any, shall be made, and at what times the fishways are to be kept open, and to give notice thereof to the owners of such dams. The action of the Fish Commissioners under these acts is unquestionably legislative in character, and we cannot doubt that their action under them, exercised and acquiesced in by the public for this length of time, is valid.

The result is, that in our opinion the action of the Board in the case at bar was the working out of details under a legislative act. The Board is no more required to act on sworn evidence than is the Legislature itself, and no more than in case of the Legislature itself is it bound to act only after a hearing, or to give a hearing to the plaintiff when he asks for one; and its action is final, as is the action of the Legislature in enacting a statute. And, being legislative, it is plain that the questions of fact passed upon by the Legislature in adopting the provisions enacted by them cannot be tried over by the court. This court has been recently asked to try over the expediency of compulsory vaccination in an action under a statute requiring it. (*Com. v. Jacobson*, 183 Mass. 242.) On its declining to do so, an appeal was taken to the Supreme Court of the United States, and its refusal to do

so was held to be correct. (*Jacobson v. Mass.*, 197 U. S. 11; see particularly p. 30; see also *Devens, J. in Train v. Boston Disinfecting Co.*, 144 Mass. 531.)

The practical result is, that the defendants are forbidden to conduct their sawmill as they had conducted it for thirty years, by a Board who have not heard evidence and have refused the defendants a hearing; that the action of the Board is final, and that no compensation is due to them.

This result may seem strange. But it is no less strange than the practical results in cases which are decided law. Take the case before the court in *Nelson v. State Board of Health*, 186 Mass. 330, namely, a farm on the banks of a pond used as the water supply of a town. The State Board of Health can pass a general regulation, under statute 113 of Revised Laws, chapter 75, forbidding privies within a specified distance from its shore; and if the defendant had had a privy there for thirty years, his right to maintain it would cease, although the order was made without hearing, and the action of the Board is final. On the other hand, if the Board had proceeded under statute 118 to investigate this particular privy, the defendant would have been entitled to a hearing, and, on appeal, to a jury, as provided by statute 119. Again, take for example the regulation of a local board of health in question in *Train v. Boston Disinfecting Co.*, 144 Mass. 523, requiring all rags arriving at the port of Boston from any foreign port to be disinfected at the expense of the owner before being discharged. The power of the local board of health to declare these rags a nuisance *per se*, so as to impose upon the owner without trial the expense of disinfecting them, was established by this court in that case. Had the local board undertaken to investigate the particular rags in question in *Train v. Boston Disinfecting Co.*, under their jurisdiction to inquire into sources of filth, and they had been authorized under that act to abate the nuisance if they found the rags to be a nuisance, by ordering them to be disinfected at the expense of the defendant, they would have had to give the defendant a hearing on notice, and from their decision the defendant would have had a right to a trial by jury. That is what was decided in *Salem v. Eastern Railroad*, 96 Mass. 431.

That is to say, on the one hand, where the law is general and the question is whether under it the defendants are committing a nuisance, the facts are determined by judicial action; on the other hand, the determination of the same facts is legislative in case the Legislature decides to make the thing a nuisance *per se*. And where it is legislative it is final, and no hearing is necessary; and where, as is the case here, it is made in the exercise of the police power, no compensation is due. The delegation of such legislative powers to a board is going a great way. But the remedy is by application to the Legislature, if a remedy should be given. In our opinion, it is within its constitutional power, and the court can give no remedy.

For similar cases, where the use which can be made of property has been left to the final determination of boards, see *Newton v. Joyce*, 166 Mass. 83; *Com. v. Roberts*, 155 Mass. 281. See also in this connection *Wares, petitioners*, 161 Mass. 70. The difference between the majority and the minority of the court in *Miller v. Horton*, 152 Mass. 540, was on the construction of the act there in question.

Exceptions overruled.

John F. Noxon for Commonwealth; Herbert C. Joyner and H. M. Whiting for defendants.

In the examination of the statute a weak point became apparent, in the fact that no public hearing was prescribed. The law has been very properly amended upon this point. We are of opinion that this amendment will not diminish the good effects of the law, as the State seeks to impose no hardship upon any class or individual, but aims at absolute justice for all. It must, however, necessarily greatly increase the cost of enforcement of this law.

The first petition for a public hearing was filed by Mr. E. E. Eames of Paxton. On November 27 the premises were inspected by Commissioners Field and Delano. The public hearing was held on November 28, at the county court house in Worcester. The conditions connected with this case are probably unique, and, as a result of the personal inspection and careful consideration of the exceptional conditions which obtain here, the following action was taken by the Board: —

According to the provisions of section 8, chapter 91, Revised Laws, as amended by chapter 356, Acts of 1906, the order issued Sept. 10, 1900, against the pollution of the waters of Eames Brook, so called, upon which this mill is located, should be, and hereby is, revoked, for the following reasons: —

(1) The unusual location of the mill, in reference to the stream and to the county road, makes it especially difficult to dispose of the sawdust as required by the order.

(2) The peculiar character of the bed of the brook and the topography of the locality tend to minimize the prejudicial effects of the sawdust pollution.

(3) The special character of the water privilege. *If it is permissible by law* to so completely shut off the water that the bed of the brook for a long distance becomes entirely devoid of water, the stream by that fact becomes uninhabitable for trout, even without the presence of sawdust.

(4) Both from a personal inspection of the stream and from the absence of direct testimony that trout have ever been taken in this brook, we are of the opinion that the fisheries in this brook are not at present of sufficient value to warrant the application to this particular brook of the law forbidding pollution of streams by sawdust.

Shad. — There are few more deplorable incidents of human greed than are displayed by the decline of our shad fisheries. Fifty years ago so numerous as to be freely used for manuring the farmers' lands, the next ten years will see the practical commercial extinction of this delicious and valuable fish on the eastern shore of the United States, unless all the Atlantic States take immediate and effective measures to supplement the work of the Bureau of Fisheries by artificial propagation, by protection of the young in ponds and by the prohibition of the taking of shad in the brackish waters of the bays and at the mouths of the rivers. For the past three years the efforts of the U. S. Bureau of Fisheries to secure eggs for propagation purposes have been negated by the comparative failure of the shad fishing.

The Bureau of Fisheries has furnished many carloads of shad fry to Massachusetts, but the fishery in the Potomac and Susquehanna rivers has during the past three years fallen so low that it has been impossible for the Bureau to secure more than about 20 per cent. of the number of eggs necessary to supply other rivers. It is clearly the responsibility of Massachusetts to make a decided effort to do its part in the work. New York and Connecticut have already undertaken the propagation of shad.

While the catch of shad reported from Gloucester is this year 931 barrels, as compared with but 40 barrels in 1905 and 380 in 1904, nevertheless, there can be no doubt that the Atlantic shad fisheries are doomed unless every State will immediately take the necessary steps to save the fishery.

The eleventh annual report of the New York Forest, Fish and Game Commission says: —

By far the most serious problem confronting the commission is presented by the failure of the shad fisheries of the Hudson River. For years this body of water was one of the most important in the country, on account of its prolific run of shad and herring; but within the past ten years, at least, neither of these species of fish have appeared in anywhere near the usual number. It would seem as if, year after

year, the run of fish was retarded by an invisible line, which annually stretched farther and farther down the river, and beyond which the fish would not pass. Formerly the shad were caught up to the Troy dam. Then the fish were sold for a very small price in the streets of Troy and Albany. Later they became scarcer and scarcer, until at present the fish do not seem to run very much above Hudson. There has been no lack of stocking this water both by the State Commission and by the United States Commission, but the results have failed to meet the anticipations of fish culturists. It is a notable fact, in this connection, that during recent years the Hudson River has become little more than an open sewer, and each year finds the conditions in this respect worse than the year before. It is the judgment of those who have considered this matter seriously that the fish will not run up beyond a certain limit of contamination in the water. Several years ago the fishermen themselves figured out the situation, and reported it to the commission. Very recently the author of a book devoted entirely to the Hudson River says, with reference to this body of water, "There can be little doubt that fish are poisoned by the fouling of the elements in which they live;" and another writer says: "Everywhere, the country over, streams once yielding a bounteous supply of fish have long since been utterly and permanently ruined by having been converted into sewers for refuse which destroys all life."

I have given particular attention to this problem, because of the importance of the shad as a food fish; and when my attention was directed to the reports of the Connecticut Commission by our secretary, I instructed him to examine into the conditions prevailing in the Connecticut River, and the methods adopted by the Connecticut Commission to meet the situation. His report advises me that their shad fisheries gradually failed year after year, until in 1892 they amounted practically to nothing. The outcry of the fishermen was such that the commission of that State made a careful study of the situation, and determined that the pollution of the water was such that the eggs deposited naturally were smothered, and the fry which did hatch were unable to withstand the condition of the water. After considerable experiment, the Connecticut Commission decided to try to raise the fry to the fingerling stage, in the hope that the larger and stronger fish would be able to withstand the condition of the water. In 1895 the Connecticut Commission secured an old water privilege on Rams Horn Creek at Joshuatown, and spent \$4,500 in building a dam and repairing two dams that already existed on the stream. Three ponds were thus created, the upper one containing seven acres, the middle one containing three acres and the lower one containing five acres. Each pond was cleaned out and the bottom sloped toward the creek which naturally ran through them to the river, and at the outlet of the lower pond screens were put in so as to prevent the fish from passing out until, in the judgment of the commission, it was best for them to do

so. The outlet of the lower pond is but a few hundred feet from the river itself, and the ponds are located about ten miles from the mouth of the river. An average of 3,000,000 fry are annually placed in the three ponds, and are fed with crushed crackers. The fry are held until the latter part of October, when they would naturally run down the river to the sea; and the gates are then raised and the contents of the three ponds released. By this time the shad are from two and one-half to four inches long, and are strong and active fish. Good results were obtained from this experiment within three years after the ponds were first drawn off, and in 1904 the fishermen caught 172,000 large shad, as compared with a catch of but 18,000 a few years before.

Hon. George M. Bowers, United States Commissioner of Fisheries, says, justly, that "the failure of the States to make adequate provision for protecting the food fish supply within their limits, more particularly the migratory species, appears more urgently to demand action on the part of Congress." He thinks the government should either assume jurisdiction over migratory fishes that cannot be regarded as the property of any one State, or should suspend fish-cultural operations in waters where its efforts are completely counteracted by the indifference of the States.

Few fish are so satisfactorily adapted for profitable cultivation as the shad, for the reason that the young fish, after being protected until late summer, when they are 2 to 3 inches long, are turned out to pasture in the ocean at nature's expense, and return two and one-half years later to the same stream as full-grown fish, and if permitted will fill the same waters with their progeny.

We earnestly urge consideration of the importance of protecting the shad industry of this State, formerly so lucrative, but now almost extinct.

The Boston "Transcript" of Jan. 2, 1907, says:—

Hartford, January 3. The annual report of the Connecticut State Fish and Game Commission was made public to-day. It says that the big Connecticut River shad industry is doomed unless sufficient measures are taken to regulate and control the capture of the fish. The commissioners say that the decrease in the run of shad in the Connecticut River during the last two years can be rightfully attributed to the direct results of the decreased number of fry available for planting in the retaining ponds.

GAME.

Pinnated Grouse or “*Heath Hen*.” — Few persons in Massachusetts realize that the island of Martha’s Vineyard still retains one feature which no other section in the whole world can boast. True, even here, this one feature has nearly vanished. Yet there is still a chance for determined effort to maintain and doubtless increase the number. Every man, woman and child in Massachusetts should know that the few heath hens now living on Martha’s Vineyard are all that are alive in the whole world to-day. It seems scarcely credible that a bird that was formerly numerous from Cape Ann to Virginia, and so abundant in Massachusetts, Rhode Island and Long Island that it was necessary to stipulate that the apprentices should not be compelled to eat heath hen meat oftener than twice weekly, should within less than the allotted time of the span of life of father and son be shrunk to the present pitiable remnants. The less than 100 heath hens now living are the sole survivors of the vast army of these birds which formerly furnished delicious food and invigorating sport for thousands of people. Whether or not the heath hen shall be blotted from the earth absolutely forever rests largely with the inhabitants of Massachusetts and particularly of Martha’s Vineyard. If the citizens individually resolve to respect the law passed last winter for a closed season for five years, and will encourage the development of a public sentiment which will prevent the killing of these birds by hunters and collectors and the destruction of the nests and young by brush fires and by stray cats and dogs, at the end of these five years we may hope to see the bird so firmly re-established that a suitable open season with satisfactory shooting may be enjoyed. Public sentiment and a loyal local pride, combined with the legal fine of \$100 for *hunting*, taking or killing, or for buying, selling or otherwise disposing of or of having in possession a heath hen, or any part thereof, for the next five years, should effectually prevent violations of the law. The number of birds is now so much reduced that even the killing of *one* bird may have serious effects.

Linnæus’s original description of the “prairie hen” or “prairie chicken” was from a “heath hen” said to have been killed in Virginia. For generations the prairie chicken and the

heath hen were believed to be identical, but in 1885 our eminent Massachusetts ornithologist, William Brewster, Esq., of Cambridge, Mass., discovered that the heath hen of Martha's Vineyard (locally pronounced "hethern") was a distinct species, differing from the bird of the Mississippi valley in size, in color and in the shape of the feathers which compose the so-called neck wings. These feathers are decidedly fewer in number, and in shape described as lance-acute.

This bird inhabits the brush plains, blueberry barrens, scrub oaks, grass lands and cornfields. Its food consists in summer largely of insects and clover leaves; in winter, of weed seeds, acorns, etc. It is far more rugged than the quail, and is well adapted to withstand the rigors of our New England climate. On account of its size, and habit of perching upon the tops of the low trees in the open country, it is a conspicuous mark for the pot hunter. Undoubtedly the great slaughter of these birds was made by the early colonists. In the neighborhood of the Plymouth and Massachusetts Bay colonies the birds were practically exterminated during the dark ages of ornithology, when the economic value of this bird was unconsidered, when there was a bounty on ruffed grouse, and when little thought was given to protecting the native song and insectivorous birds on account of their value as destroyers of insects. It lies well for the dog, and its strong, rapid flight makes it a very satisfactory mark for the sportsman. The flesh is dark, of delicate texture and delicious flavor.

Since comparatively few persons have had an opportunity to study the habits of this rare bird, the following, from notes made in the field, may be of interest:—

Field Notes on the Heath Hen (Tympanuchus cupido).

MARTHA'S VINEYARD, May 1, 1906.

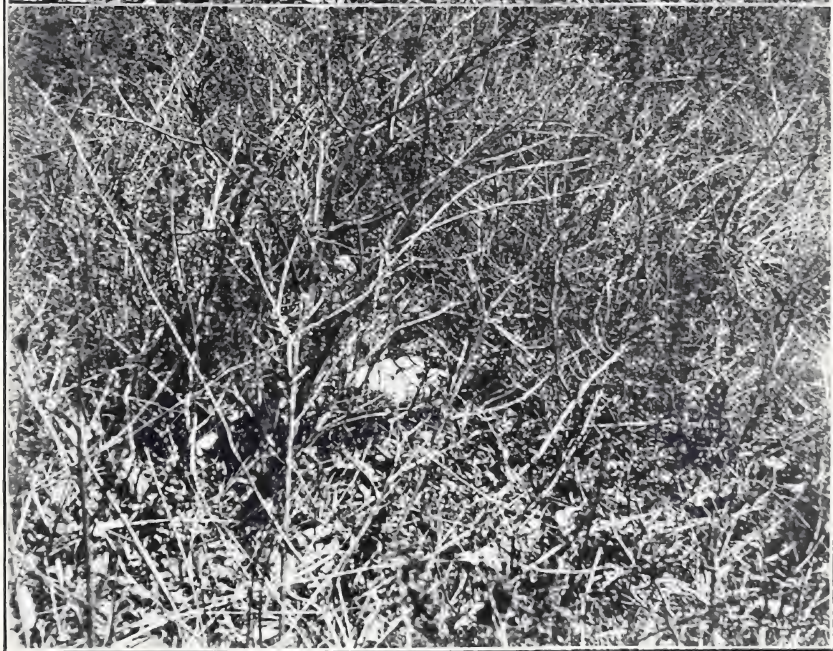
At 6 P.M. we arrived at the point where we hoped to find traces of the heath hen. In a cleared field about 30 rods from the road we distinctly saw two large birds. On our nearer approach they squatted close, and their protective coloration was so effective that, although we knew almost exactly the precise location of the birds, we could not distinguish them. We crawled behind the nearest cover, and remained motionless for perhaps ten minutes. At length the long shadows from the descending sun enabled us to distinguish the birds as they crouched

with head close to the ground, among the very scanty vegetation. After another interval of motionless activity on our part, one bird quickly arose and began feeding, apparently without suspicion; soon two more birds arose as if by magic from the ground. Then began the most interesting series of antics which it has been my lot to see. These birds were joined by five others, coming in singly and on foot from the scrub in various directions. The birds came frequently within forty paces of our hiding place, and in one instance alighted on a small oak tree twenty-three paces from our camera. While not near enough for successful photographing, we were well situated for using our field glasses. The birds were all actively feeding in the open field, apparently on grasshoppers and other insects, but nipping red clover leaves very freely. They moved leisurely about. Frequently two birds, sometimes as much as one hundred to one hundred and fifty yards apart, ran directly towards each other, dancing and blowing on the way, with neck of a two-drachm homœopathic vial. Each call extends over a period pointed upwards in a V form. On facing each other, both squatted and remained motionless from one to five minutes. We could see none of the nodding and pecking motions of the head so commonly indulged in by domestic fowls when fighting; rarely was there sparring with the bill or striking with the feet and wings. In twelve or fifteen encounters only three or four times did they strike thus, and only once did we see "feathers fly." Most of the energy seems to be spent in posturing and blowing. Generally one of the combatants backed slowly away, suddenly stopping if the opponent advanced too rapidly. In all these fighting tactics the similarity of habits with those of the domestic fowl were very marked. From all directions came the peculiar "toot," like distant tug boats in a fog, all having whistles of the same pitch. This call may be well imitated by blowing gently into the neck of a two-drachm homœopathic vial. Each call extends over a period of two seconds, and is repeated at frequent intervals. It is prefaced by a run of about one yard, with very rapid, mincing steps. The strides, however, are so short that the bird does not advance rapidly. The tail is spread and the wings dropped after the manner of the strutting turkey cock. When the tail is spread the white under tail coverts are conspicuous and remind one forcibly of the "white flag" of the deer and antelope or of our grey rabbit. The head is then depressed and the neck outstretched forward until it is about parallel with the surface of the ground; the neck tufts are elevated to a V shape. The bright, orange-colored air sacs on each side of the neck directly behind the tufts of feathers are slowly inflated until they reach apparently the size of a tennis ball, when they appear like two small ripe oranges, one protruding from either side of the neck. The duration of the call appears to closely coincide with the period of inflation, and seems to be emitted as the air enters the sac, rather than when the air is expelled. The collapse of the sac is sudden. The sound is ventriloquial,

and it is very difficult to locate the direction or distance whence it comes, unless the bird can be seen. A second sort of call is much less frequent, and closely resembles a single syllable of the hoot of the barred owl.

Another characteristic antic was a peculiar combination of a short run, a sudden jump of three to five feet into the air and a rapid unco-ordinated flop and scramble in the air, the bird usually alighting within ten or twenty feet of the starting point, but turning so as to face at least at right angles, or even in the opposite direction from which it started. When in the air it emits a peculiar cacophonous call or cackle, which when heard at a distance gives the impression of a hearty burst of laughter. The purpose of these semi-somersault-like maneuvers appeared to be to attract the attention of other birds, possibly even as a challenge, for frequently they seemed to precede the somewhat pacific duels described above. The effect of these sounds, together with the "tooting" calls in the mists which so often obtain in their habitat before sunrise, is weird in the extreme. At 4.15 A.M. on May 2 these sounds were practically continuous, without appreciable interval, apparently from all directions. At 4.45 A.M. six birds could be counted, all in sight at once. They appeared to resort to a particular clear space of about two acres in extent, where the antics just described were carried on. All the birds except one were observed to have the orange-colored air sacs. These were probably cocks. We saw only one bird which we suspected might be a hen. The other hens were probably nesting, or at least had secured mates, and no longer resorted to the promenading place. As the sun rose high the "tooting" became less frequent; the birds became more restless, often flying to the neighboring low oaks, resting there until disturbed. The flight reminds one of that characteristic of the carrion crow or black vulture of the south (*Catharista urubu*),—a succession of four to ten strong, rapid wing-beats, followed by a sail of one hundred to two hundred yards on set wings; this is repeated until the bird again alights or passes beyond the range of vision. The line of flight is usually a straight line, twenty to twenty-five feet above the ground. Of our native birds, the manner of flight most resembles our marsh quail or meadow lark (*Sturnella magna*).

The bird gives one the impression of admirable adaptation to the open country,—a large, muscular, hardy, vigorous bird, able to withstand snow and sleet, in size equal or even exceeding the ruffed grouse in weight. Inhabiting open fields and pastures, subsisting on insects, leaves, seeds and wild berries, in a country where the absence of foxes and raccoons reduce the numbers of its enemies practically to cats, men, skunks, field mice and rarely some species of hawks, the problem of maintaining and bringing back the bird to its former abundance seems practicable. According to our observations during May, we



Country inhabited by the heath hen. In foreground, nest of heath hen, with complement of nine eggs.



Heath hen on a stunted oak tree. This exposure was made in the early morning; the tree and bird have been retouched.

estimate that the number of birds of this species now alive in the whole world does not exceed 80. We actually counted 21 birds, none of which, we were reasonably certain, was counted twice.

Rearing Game Birds in Confinement. — In December, 1904, His Excellency Governor Bates urged upon this commission the importance of devoting increased attention to the "propagation and distribution of game birds."

Pheasants. — Since 1895 Commissioner Brackett has made several attempts at propagating not only ruffed grouse and quail, but also certain species of birds not indigenous to the New England States, *e.g.*, the California and the mountain quail from the Pacific States, the red-legged partridge, the black game and the capercaillie from Europe. For various reasons, chiefly from infectious diseases, induced in considerable measure by lack of suitable and sufficiently extensive quarters, these attempts yielded nothing but experience. The introduction of the Mongolian pheasant (*Phasianus torquatus*) from Oregon, however, was successful, and attention has been practically confined to rearing and distributing this bird. In spite of the ravages of cats, rats and disease, many thousands of young Mongolian pheasants have been liberated in all sections of the State. Notwithstanding the fact that the Mongolian pheasant is a more difficult bird to rear in confinement, it is believed to be a hardier and better game bird, after liberation, than the English black-necked pheasant (*Phasianus colchicus*).

Many public-spirited citizens in Massachusetts have reared and liberated both the black-necked and the ring-necked pheasants in large numbers, so that now in the State we find both of these species and their crosses.

All sorts of opinions have been expressed upon the wisdom of the introduction of the pheasant into New England. It is claimed, and we believe with some truth, that pheasants may do injury to certain market-garden crops, particularly to peas, corn and small fruits in the early spring. Our personal observations indicate that this damage is not general, and is relatively slight. In the case where we carefully noted the damage done by five Mongolian pheasants which daily came to the writer's garden in Sharon, we found that the damage to one-fourth acre of peas

was less than one per cent., and to the early strawberries less than two per cent. Later, when fruits became more abundant, the damage was too slight to be reckoned. On one acre of early sweet corn the damage was not appreciable, for the reason that the pheasants did not pull all the sprouts in the hills, as do crows, but merely thinned out the plants. No other damage was noted, though carefully sought.

The complaints of damage by pheasants have been investigated so far as our facilities permitted. The following is taken from the daily narrative report of Deputy H. A. Bent, as indicating the conditions in a section of the State where pheasants are especially abundant:—

Tuesday, May 1. Went to Boston; reported at office. Then, by order of commissioners, went to Danvers with a list of names of persons who had complained of damage to their garden by pheasants, to learn, if possible, the extent of the damage.

At George H. Clark's I found the rows of corn torn up, and large bird tracks along each row. Went in the woods near by and started seven pheasants; came out and sat down near the field of corn, and about 3.30 saw five pheasants come into the field, dig up and eat the corn. I went up to them; they left the field, and I dug down, and there was no seed to be found where they had been.

Then went to Daniel Pope's place. He was not at home. His family said that there had been no damage done there this spring, to their knowledge.

Wednesday, May 2. Went to see Mr. Hill on the Proctor farm. He was not at home. His man showed me where the pheasants had dug up the seed where he has a lot of peas planted. Tracks were plenty where the pheasants had been, and I could find no seed in places where they had been.

Fred H. Woodbury said that the pheasants had not done him twenty-five cents worth of damage up to the present time.

William S. Webb said that pheasants had done him no damage up to the present time, but that they were a common nuisance.

Joseph Bushby said the pheasants had done him no harm this year, and could not show me anything; so I went to the office in Boston, and came home to-night.

On the other hand, as indicating that many farmers are favorably inclined to the pheasant, is the fact that when the law permitting the shooting of male pheasants (section 1, chapter 482, Acts of 1906) went on, many land owners posted their

grounds for the express purpose of preventing the killing of these birds. In general, however, the opinion that the pheasant is on the whole an injury to the farmer is generally held. At present, however, there are too few birds and too little accurate observation to make a satisfactory generalization. The fact that the pheasant regards the gypsy moth as a staple article of diet, and that each bird will destroy more than a quart a day, where opportunity offers, will do much to offset occasional depredations early in the season in the gardens.

Many sportsmen, too, have looked askance at the pheasant, as being a bird illy adapted to our active methods of hunting. While well suited to the European method, where such game is shot from stands, and where the actual hunting element is eliminated through driving the game past the stands where the shooters are located, in their opinion, the pheasant would not "lie to the dog" as do our best game birds. The actual experience, however, of the past open season has convinced the majority of these sportsmen that their preconceived opinions were not well grounded, and that the pheasant quickly develops an ability for taking care of himself which furnishes abundant and satisfactory sport. Beyond this, the rich and even gorgeous plumage, and the quality and quantity of the meat, have brought the bird into distinct favor.

An important question to be solved, however, is the effect of the contact of these birds with quail and ruffed grouse. It is generally claimed that pheasants "drive out" native birds. Accurate observations and convincing testimony on this point is at present lacking.

But most serious of all is the question whether the parasite (*Coccidium avii*) and other diseases which are characteristic of pheasants may not be even more fatal to quail and possibly to ruffed grouse.

Our own observations indicate that the greatest enemy of the pheasant is the fox. The pheasant does not, like the quail, at night gather in compact bunches, with the individuals facing the circumference of the circle, and ever ready to fly like a bursting bomb, either to the disconcertment of the enemy or with a minimum loss to the flock. Quail are so watchful at night that our attempts to photograph them "in the family

circle" by flashlight have given only streaks on the plate. Unless the pheasant acquires a similar habit, or takes to roosting upon trees instead of upon the ground, it cannot multiply rapidly in the more remote portions of the State, where foxes are numerous. On the whole, however, we are of the opinion that the Mongolian pheasant is a valuable bird for this region; and we believe that sportsmen will not be averse to giving to our respected colleague, Commissioner Brackett, the credit which is due to him for the successful introduction of these birds, and also for the attempts to naturalize other species, which failed only as the result of conditions which it was not possible at that time to foresee or forestall.

Large numbers of the birds which have been liberated have been shot and snared; but this year, during the open season of one month, upwards of 200 male pheasants were brought to taxidermists to be mounted.

While it appears that the balance of credit is due to the pheasants on account of the pleasure which they afford, of the value of the meat which they furnish, and of the gypsy moths, cutworms and other insects which they destroy, we nevertheless feel that increased attention should be devoted to the propagation and liberation of some of our native game birds, especially since we alone, of all the States east of the Appalachian mountains, are by nature especially favored with the presence of all three of the chief indigenous game birds of eastern North America, namely, the quail, the ruffed grouse and the pinnated grouse (prairie chicken or "heath hen"). Therefore, we have, as far as our limited funds permit, begun a systematic attempt to rear, under artificial protection and in a state of semi-domestication, all three of the birds, both for the purpose of securing knowledge which may later lead to commercial propagation by individuals under proper conditions, and of developing a flock of breeding birds which will yield sufficient increase to properly re-stock depleted sections. Our experiments this year lead us to the belief that under proper conditions both quail and ruffed grouse can be reared by thousands after the manner of chickens.

The total number of pheasants distributed from Winchester this year was 144. This small number is due to the fact that some animal, probably a mink, broke into the coops and killed

30 adult and 79 young birds. Further, the ground has been used for several years by successive generations of pheasants, and it is now undoubtedly somewhat contaminated, in spite of active and intelligent attempts at disinfection by use of lime and other agents, by shading and changing locations of coops, etc.

The need of more extensive facilities for rearing game birds is obvious. The encroachments of real estate development in Winchester, however, make us question the expediency of further developing this pheasantry, since inevitably the fight against cats, rats, mice, disease and other conditions of city and suburban life is now practically continuous. Large areas of cheap, unimproved land, embracing fields, bushes, woods, springs and streams, are necessary for the successful and economical prosecution of this branch of the work.

The following portion of the report of Superintendent Merrill of the Sutton station indicates the conditions there: —

Pheasant Hatching at Sutton. — For feeding the pheasants a large quantity of bread, made of mixed ground grain, and containing milk, meat and bone, was made, dried and broken up in a corn cracker. This was fed freely to grouse, quail and pheasants, and in the case of the old pheasants increased the egg production 50 per cent., or from 800 to about 1,200.

The weakness of the eggs and chicks, that for several years has resulted in poor hatching and difficult rearing, continued, and it is hardly to be doubted that it is the result of so many years of breeding from the same stock. An added difficulty was an epidemic of cholera among the chicks during the hot, moist weather of midsummer; and the lots that hatched at that time, usually the largest, were completely exterminated. The loss amounted to over 200, and reduced the number of birds raised from a probable 125 to 75.

This disease has caused a moderate loss each year, and sometimes quite a serious loss in certain lots, but never to the proportions reached this year; and if pheasant raising is to be continued, it should be guarded against by shifting to fresh ground frequently (which, however, is open to the objection that it would restrict the ground that could be used for grouse or quail, and possibly extend the disease to them), or by discarding hens for rearing, and using brooders, as is generally practised by pheasant breeders.

Quail. — On March 16, 1906, His Excellency Governor Guild referred to this commission a strong petition, signed by

Leonidas L. Hamilton and others, requesting that attention be directed to protection and propagation of our native quail (*Colinus virginianus*). The following report was made:—

APRIL 24, 1906.

To His Excellency CURTIS GUILD, Jr., *Governor of the Commonwealth, State House, Boston, Mass.*

SIR:—The Commissioners on Fisheries and Game respectfully present the following brief report upon the petition of Leonidas L. Hamilton and others, for the further protection of game in the State, which was referred to this Board on March 16 by your order.

There can be no question of the great economic value of quail as a farm crop in Massachusetts. Its value lies in its remarkable efficiency as a destroyer of insects, cutworms, potato bugs and gypsy moths. Its æsthetic value in the landscape is also a feature of considerable importance. As a game bird, it may readily be made the most important in the State. As a bird, alive or dead, in the market it brings from \$5 to \$10 per dozen, and the demand far exceeds the supply.

Unfortunately, climatic conditions make it difficult for the quail to maintain itself in Massachusetts, which is practically the northern limit of its geographical range. Deep snow, bringing scarcity of food and inaccessibility of gravel, cause many deaths from starvation. This, together with the natural enemies, for example, foxes, bird dogs and particularly cats, have been responsible for the death of more quail than have sportsmen. Relatively few quail are killed by hawks and owls. Nevertheless, on account of its great economic value, as indicated above, well-directed efforts should be made to furnish to the quail practical assistance in maintaining itself, by providing covers and feeding places where it can obtain under all conditions grain, gravel and nitrogenous food. Quail can endure our severest cold, provided they have food, gravel and shelter from snow; therefore, it is perfectly feasible to furnish the relatively small but necessary degree of assistance to nature.

This commission has already begun preliminary experiments to ascertain the best methods of rearing quail and native birds, which are of value as insect devourers, for stocking the covers. Attention will be given particularly to maintaining the native birds, rather than imported species. The methods employed thus far are rearing quail in confinement in pens, and also by stocking suitable farms, where food can be readily provided, where hunting is absolutely prohibited, and where special effort is made to control the enemies of the birds, particularly the cats, dogs, foxes, skunks and forest fires. Should these preliminary experiments warrant, we hope next year to undertake on a practical scale the propagation of quail, ruffed and pinnated grouse, which are of undoubted economic value.

We therefore respectfully suggest that action upon the petition be postponed until next year, pending the results of our experiments.

Respectfully submitted,

GEORGE W. FIELD,

Chairman.

Unfortunately, Massachusetts is practically the northern limit of the quail's habitat; consequently, bobwhite here leads at best but a precarious existence under natural conditions. At frequent intervals the flocks are almost totally destroyed by severe storms of snow or sleet; then follow years of scarcity, until the few survivors, augmented by the limited number of individuals which gradually push toward the frontier, again multiply. The quail is a comparatively prolific breeder under favorable conditions, and for this reason the tides of abundance and scarcity of individuals follow in relatively rapid succession. Observations indicate that the quail can withstand practically any degree of cold which comes to us in Massachusetts, provided there is shelter from sleet and snow, and an abundance of gravel and suitable food accessible. These untoward conditions of climate can therefore be readily ameliorated by furnishing the shelter and feeding places near every farmhouse and upon every estate and private or club preserve where the quail could be reduced to a condition of semi-domestication. In isolated cases this has been done in a limited way for many years. But the credit for the extension of the practice and the widening interest in the quail should be given to the sportsmen and to the various associations, notably the Massachusetts Fish and Game Protective Association, and to public-spirited private individuals. For years the Massachusetts Fish and Game Protective Association has bought large numbers of live quail from the southern States and liberated them, through the co-operation of clubs and individuals who undertook the care of the birds and shared the expense. To these efforts are mainly due whatever quail are now inhabiting our covers.

But this bird is not for the sportsman alone. The farmer is beginning to realize the value of an ally which eats stupendous numbers of weed seeds in the fall and winter, and spends the long summer days in destroying the cutworm and the potato beetle. Moreover, the quail's cheery whistle and the melodious

"scatter calls" are assets of country life which the farmer and the country or suburban resident now appreciate more than ever.

Within the past few years the market demand for quail on toast has made such inroads upon the supply that the gradually diminishing area of uncultivated land no longer yields sufficient to satisfy the sportsman, the *bon vivant* and the farmer. Interstate commerce in quail, formerly enormous, is now rapidly diminishing under laws restricting or even prohibiting the export of quail, either alive or dead, over the State lines. Such laws are now in the various statute books of every State except one, and are becoming increasingly well enforced in most of the other States, so that each year it becomes more difficult to secure birds for stocking covers, or even for propagation in less fortunate States. Under these conditions systematic propagation and intelligent persistence in overcoming difficulties is essential in Massachusetts if the quail supply is to be maintained. That an abundant supply is desirable from the sportsman's point of view has been proven by the alert interest and the not entirely selfish efforts of the sportsmen in spending large sums of money to purchase, transport and feed southern quail in the State, and the care not to destroy entire coveys, or even to abstain entirely from shooting at times of scarcity of these birds.

Our attempts to get a satisfactory stock of breeding birds emphasized most strongly the fact that for maintaining our game birds reliance can no longer be placed upon stock secured from other States, from the fact that transportation from a distance is expensive and destructive, even to such a degree as to lead to a reasonable doubt as to the wisdom of such undertakings.

The following, reprinted from the Boston "Transcript," indicates the opinion of the United States Department of Agriculture:—

ACTION RECOMMENDED BY THE DEPARTMENT OF AGRICULTURE.

The thorough re-stocking of game covers is urged in a report issued by the Department of Agriculture in a report on "game conditions in January." "Now that the hunting season is practically over," the report says, "the Biological Survey suggests that efforts be directed toward insuring more effective production of game and an adequate supply for the future. Owing to the non-migratory character of quail,

and the consequent depletion of various localities where hunting has been excessive or the birds have been killed off by the severity of the past two winters, re-stocking is frequently necessary; but the demand for live birds for this purpose far exceeds the available supply. The game commissioners of some States, particularly Massachusetts and New Jersey, for several years past have endeavored to obtain a supply of quail, but have been only partially successful." The report adds that in various States "grain and other food have been distributed after heavy snowfalls, when the usual food is covered, and suitable shelter has been provided." Much activity prevailed last year in Illinois, Indiana, Massachusetts, Maryland, New Jersey, North Carolina and West Virginia. Such measures are needed to preserve the quail from possible ultimate extinction; for, with a growing army of sportsmen hunting them annually, their ranks are each fall reduced so far below the normal that, if the succeeding winter happens to be severe, extermination of many colonies is almost sure to follow. Such a result is deplorable, not only from the standpoint of the sportsmen, but, owing to the great value of the quail to agricultural interests as a destroyer of insects and the seeds of weeds, from that of the farmer as well.

It frequently happens, too, that people who attempt to purchase western quail secure quail from Texas instead of from Kansas, as shown by the following statements from the Houston "Post," early in March, 1906:—

Secretary George Tucker of the State Sportsmen's Association is in receipt of a letter from a Brenham gentleman, dated Wallis, March 13, in which his attention is called to what the gentleman believes is an evasion of the game laws of the State, and which at least demands the attention of the association at once; and the attention of the committee appointed by the association at its last Waco meeting is called to this statement, which will be a revelation to the sportsmen of Texas. The letter states:—

While in Wallis this morning I noticed a consignment of live quail from a Texas shipper to a Kansas town. There were in this shipment 750 quail, and it was stated that between 7,000 and 8,000 live quail had been shipped through this section en route to the same destination. The birds were all our regular brown variety, except a sprinkle of the blue quail.

A printed card attached to each case read as follows: "*This live game is shipped from Texas for scientific and breeding purposes, and the shipper has filed his affidavit with the express agent according to law.*" It is reported that the government is back of the enterprise, but the knowing ones deny this; anyway, there is no sign of Uncle Sam's approval or connection with the matter, and even if there was, it is hardly probable that he would require thousands of them. A northern man was heard to remark that each

quail brought 75 cents to \$1 after it was scientifically prepared for the table, and many strongly suspect that there is where the "scientific purposes" end. It is reported that on a few occasions the officers in the Territory have opened the coops and set the birds free, which should be done here in Texas. Whether the government, or the hotels, or any one else, is back of this enterprise, it should be stopped immediately. There is a law against trapping these birds, and it is a burning shame to have our live quail shipped out of the State by the thousands. It is not justice to our people who obey the game laws of Texas; it is unjust to our sportsmen, all the way from the man with the hammerless gun and earless pup, smokeless powder and steel shot, down to us fellows with the door shutter and a trigger.

The opinions outlined in these statements have crystallized into laws which reflect a public sentiment so thoroughly aroused to the value of the native birds that it is becoming extremely difficult to secure birds for transportation outside of the State. Alabama alone now stands without restrictions upon the shipments of birds.

The general conditions of the quail situation are shown in the following statement:—

The depletion of quail covers by recent severe winters has resulted in vigorous efforts in various parts of the country to secure birds from sections where they still abound. The quail of Mexico were drawn on, and 148 bobwhite and 2,400 Mexican quail were imported and shipped to northern points. These proved unsatisfactory, and native quail were sought to meet the demand. Owing, however, to the strict and comprehensive non-export laws of most of the States, the supply of available birds has been far below the demand, and consequently the stock of quail in those States from which the birds could be legally secured has been recklessly diminished; in other States, violations or evasions of the law have occurred. In Alabama a few shippers furnished eastern and northern States with enormous numbers of quail, which it is by no means certain will be able to withstand the climate of the regions where the birds were liberated. A similar attempt to meet the demand was made in Texas, where, however, the State law was violated, and the quail trappers were arrested and confined in jail.

Despite these strenuous efforts to supply the demand, and despite all attempts to meet the deficiency by proper and moderate transfer of domestic birds, the demand continues greatly in excess of the supply. If such depletion recurs, better methods will have to be devised to restore the normal abundance. To stock one part of the country at the expense of another, without careful safeguards to prevent depletion of the covers drawn upon, is mistaken policy. The supply should be taken

from a number of points, to avoid too great a drain on limited localities, and all trapping and export of birds for propagation should be under State control, and not left to unchecked individual enterprise.

Before the demand for quail can be satisfied, means must be devised whereby the birds can be propagated profitably on a commercial scale. It is estimated that during the past year Alabama furnished about 100,000 quail, and the west and southwest 50,000 more. Prices ranged from \$4 to \$5 per dozen for southern birds, and \$10 a dozen for those from the southwest. Thus, all told, \$75,000 to \$100,000 worth of quail were required for a partial supply of the existing demand. Severe winters are likely to recur, and, even under favorable climatic conditions, excessive hunting and the rapidly increasing number of game preserves will create a constant demand for birds for propagation. Already quail have been raised in confinement in an experimental way, but with varying success. All the difficulties have not yet been overcome, but they are not insuperable, and it is to be hoped that State or private enterprise may successfully meet them at no distant date.¹

To secure satisfactory results, economic methods must be devised for hatching and raising quail in larger numbers and with a less percentage of loss than occurs under natural conditions. This has been successfully done in the case of many other species of birds, which in time have developed under domestication wonderful improvement both in size and in fecundity.

The experience of ourselves and others demonstrates, however, that there is still much to be learned before completely successful propagating methods can be devised for use by amateurs. The most conspicuous difficulties thus far experienced are connected with securing satisfactory breeding stock, *e.g.*, birds strong, tame and free from disease; methods of securing a large supply of eggs; hatching and brooding the young birds in such a manner as to avoid exposing them to any one of several infectious diseases, to which both the quail and the ruffed grouse appear to be particularly susceptible.

Our most satisfactory breeding stock was birds from North Carolina, obtained through the courtesy of officials of the Massachusetts Fish and Game Protective Association. These were supplemented by other birds from Kansas and Alabama. Prac-

¹ From p. 13, report of the Acting Chief of the Bureau of Biological Survey for 1906, by Henry W. Henshaw, Acting Chief. From annual reports, Department of Agriculture.

tically all of these latter birds died from a disease closely resembling chicken cholera.

These quail were probably trapped by negroes, who kept them in coops or other quarters used by hens, turkeys or pigeons. They were then brought to the country store, where in similar but more crowded quarters they awaited the day of shipment. As we have proved this year, quail and ruffed grouse should never under any consideration be placed in coops or boxes in which pheasants or domesticated poultry have been confined, or permitted to run over ground where such birds have had access, or even to drink water flowing from such ground, on account of the likelihood of becoming infected with the bacilli of chicken cholera or the animal parasites *Amæba melæagridis*, *Coccidium avii*, which, while not always fatal to pheasants and domesticated fowl, appear to be singularly fatal to quail and ruffed grouse.

In addition to the birds probably infected before arrival, and which died from chicken cholera, we undoubtedly lost many birds as a result of placing them in pheasant pens, where they became infected with the internal parasite, *Coccidium avii*.

The breeding pens which were devised proved to be especially satisfactory.

Circumstances did not permit us to get the birds into the pens early enough to ensure early mating, and egg laying was probably somewhat deferred on that account. The first eggs were found June 10.

We intended to take some of the eggs from the nests for hatching under bantams, and leave other clutches to be hatched by the quails, but so many nests were either abandoned or the eggs eaten by field mice that it seemed best to take away all of the eggs. In several instances, however, nests were so securely hidden that the quail hatched the young within the pens. Just how many were thus hatched could not be determined, on account of the heavy undergrowth. The total number put in was 47; of these, 19 were known to have died; others doubtless died, but were not found. The number of birds which were in the pen when the falling leaves again permitted a view of the interior was 21. Many eggs failed to hatch on account of lying in the nest too long, from lack of systematic collection and the

substitution of satisfactory nest eggs. Many eggs were broken by the hen by too energetic brooding. We have arranged to substitute the incubator. The eggs were collected every day, but were kept until there were enough to set two or more bantams on the same day, for the purpose of securing a considerable number of young at once for convenience in feeding. The young proved in no degree refractory or difficult to handle or feed. The food was so varied that an abundance was readily obtained. The first lot of young were brooded by a bantam, but with the appearance of the same disease which had mown down the young ruffed grouse they were taken from the hen and placed in a Model brooder, and the disease was checked. All subsequent hatches were reared in brooders having the runs upon uninfected ground. No subsequent attack of the amœbic disease appeared, and the quail grew rapidly. At the present stage of the work it is not deemed expedient to actually weigh the birds, but from appearances the young reared here with abundant and varied food appear decidedly larger than the parent birds. For the coming year we have constructed another enclosure, containing 15 breeding pens, and hope to secure an increased stock of breeding birds, in addition to the 24 young reared this year in confinement, and the 13 survivors of the original stock of wild birds.

An extract from the report of Supt. Arthur Merrill of the Sutton hatchery follows, and furnishes further details, particularly as to methods of feeding: —

The breeding quail received in February and in March were put into the old pheasant pens, in which an abundance of brush was placed to give them hiding places. Two serious disadvantages were quickly discovered, which doubtless affected the health of the stock: the dusting places soon became wet, and could not be supplied with dry dust; and the birds kept so close under the brush that their hiding places became very foul. Both conditions were rendered worse by the heavy fall of snow in March.

Two lots of North Carolina quail, though considerably reduced, supplied the greater part of the brood stock, — strong birds that bred well. One lot of Alabama quail was practically all lost, the circumstances indicating disease. A smaller lot of supposed Alabama quail did better, and supplied some breeders for the pens.

A lot of Kansas quail received late in the spring, and kept in the old

pheasant pen, did very well in the beginning; but many were lost during the summer, at a time when the others in the new breeding pens were in the best condition. This was evidence that the old pheasant pens were the source of disease.

As soon as possible after the arrival of the quail, 10 new pens were built, covering 6,500 square feet of rough ground, having an abundant growth of brush, and traversed by a water course which supplied water to most of the pens. The pens were built across a gully running nearly east and west, — as experience proved, a most advantageous feature of the location. During the hot weather of summer the birds lived in the shady side, crossing over to the sunny side in winter, living there and in the dust shelter at the top of the bank. When disturbed by the work about the pens the long flight which the length of the pens permitted them to take was rendered harmless, as in flying they crossed the gully and alighted on the steep bank. Varying numbers were put in the breeding pens, — a pair, a male and two females, and two males and three females. No quarreling was seen, and the birds mated without regard to the number in the pens; while, so far as could be told, there was no difference in the fertility of the eggs.

Early in May the first quail nest was found, but it was nearly a month later before the first eggs were laid. Through June eggs were collected slowly, the majority of the birds not beginning nesting until July; but they laid well through that month and the first part of August, with a few scattering eggs until September.

The number of nests found considerably exceeded the number of females in the pens, many birds abandoning their nests and making new ones, especially early in the season. Later they showed less alarm when the pens were searched, and quickly returned to their nests when disturbed. At first they showed little inclination to attempt incubation, but later they did quite generally, hatching out six broods and attempting many others. The nests were so generally distributed in the pens — not one but what contained as many or more nests than females in it — that it appeared reasonably certain that no bird failed to nest. In one pen where no eggs were secured the hen made two nests, and circumstances indicated probability of robbery by mice, if eggs were laid.

Eggs were removed from some nests as soon as laid, in hopes that the birds would continue to lay. In two instances this was successful, from one nest 22 eggs being taken and from the other 29; but in most cases the nests were abandoned.

The nests showed the widest possible range in manner of building and concealment, varying from slight depressions scratched in sheltered places to elaborately arched structures, some so well concealed that they were not found, the presence of young proving that the birds had nested. The number of eggs scattered about the pens was very small at the beginning of the nesting season, and later practically none were found out of the nests.

The eggs were placed under bantam hens and hatched with varying success, at first very good, the first hen hatching every egg. Later, hatching was unsuccessful, due to the breakage of eggs by the hens, which was much more frequent than in the case of pheasant or grouse eggs, even when the latter were placed under large hens. This was due to the very fragile shell of the eggs, and more to the eagerness of the hen to cover them than to carelessness or roughness. The main cause of the failure to hatch resulted from leaving the eggs in the nest, with the intention of letting the quail hatch their own. In most instances they failed to do this where the nests were visited, though there was only one case where it was certain that the nest was abandoned after incubation commenced. Several nests were found, the eggs apparently having been laid a long time before they were discovered.

To secure fresher eggs and get a better hatch, frequent and more thorough searches will be necessary, with the removal of all of the eggs as soon as laid, replacing them with artificial eggs, to keep, if possible, the birds laying in the same nests.

A number of chicks were killed by the hens; but in the future, if it is necessary to use hens for hatching, this trouble might be avoided by doing the hatching in a room that could be darkened when the chicks were coming out.

Two lots of chicks were kept under hens for a few days, and a loss of twenty resulted; but of the whole lot, numbering 72, placed in the brooders, only 10 were lost from any cause during the first three weeks, nearly all of these 10 dying the first days from apparent weakness. No loss could be attributed to the food, and none from the disease that destroyed so many grouse and pheasants under the age of three weeks.

The first three lots, numbering 40, suffered a loss of only 3 when young; then until nearly mature a loss of only 4 from cats and accidents. When nearly grown, the amœbic disease¹ caused a loss of 7 in the two oldest lots. The third lot went through the whole period of life in the brooder and small pen attached nearly three months without loss. All of these lots were on the same ground, which was infected with the *Amœba* early in the spring by hens passing over.

Promptly upon the appearance of the disease the coops were moved to fresh ground, and moved again after any loss suspected to be from the disease, until the loss ceased.

Of the two younger lots, one escaped the *Amœba*; the other was attacked at a very early age, because the coop chanced to be placed on ground more liable to infection. Both lots having been hatched very late, the early cold weather of the fall caused them to keep close to the heated brooders; and it is believed that this overheating was the cause of an attack of diarrhœa, that caused a heavy loss in these lots. The heat used was not greater than for the early lots, but the early lots

¹ Caused by the intestinal parasite *Amœba metacagridis*, which causes "blackhead" disease in turkeys. For further details, see below, in reference to ruffed grouse.

stayed out in the grass practically all the time, day and night, while the late lots at the same age kept as closely to the brooder.

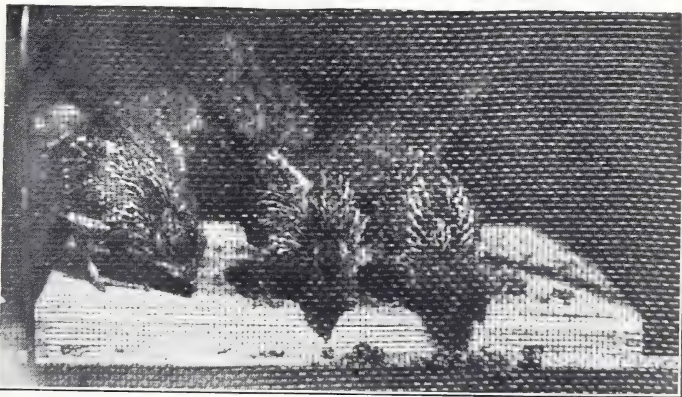
The yards attached to the brooders varied in size from 16 to 250 square feet; but no difference could be observed in the health or vigor of the birds that could be attributed to any advantage of one pen over another, but this would hardly apply to partly mature birds taken from the brooders. If overcrowding is avoided and green food supplied it seems as though the birds will thrive in small pens as well as in large, and in the small pens become much tamer. They need no special attention, except to keep them tame, and, if supplied with dust and food and given a suitable temperature (starting at 95° and dropping gradually every two or three days until after four weeks 80° F. is reached), will take care of themselves. A good example of this is the way in which one lot, kept for a brief period under a hen, rid themselves of head lice. When it was found that they were rather badly infested, they were supplied with dust. They burrowed in it vigorously, and very quickly cleansed themselves of the lice. So little difficulty was experienced in feeding the young quail that the only problem seemed to be the best food for a large stock of birds. Flies, maggots, ants and ant eggs, dried and fresh, were used for animal food, and any of these alone would supply that part of the ration. Fine grain and seed was eaten from the first, and formed a larger proportion of their food than it did of the grouse. This fondness for seed continued through the season, and nothing was eaten more eagerly than the seed of various weeds supplied to them. Green food was freely eaten, especially lettuce in boxes. Like the grouse, the birds as they grew up stripped their pens of everything green.

Not all of the berries and fruit fed to the grouse were available for the quail. The season for strawberries and blueberries had passed; raspberries, though very freely eaten, could not be supplied long; blackberries were eaten, but not as eagerly as the raspberries. Elderberries were used more than any other, as they came at the right season and were more easily taken by the birds. For natural fruit food nothing is so promising as the elderberry. Probably it will give very satisfactory results if cultivated. The hatchery grounds contain an abundance of soil suited to it. Other foods that can be profitably cultivated or collected are wild cherries, and any weeds that can be gathered without shedding seed. Foul seed which is mostly weed seed can be obtained from threshing machines, and should form an abundant source of suitable food.

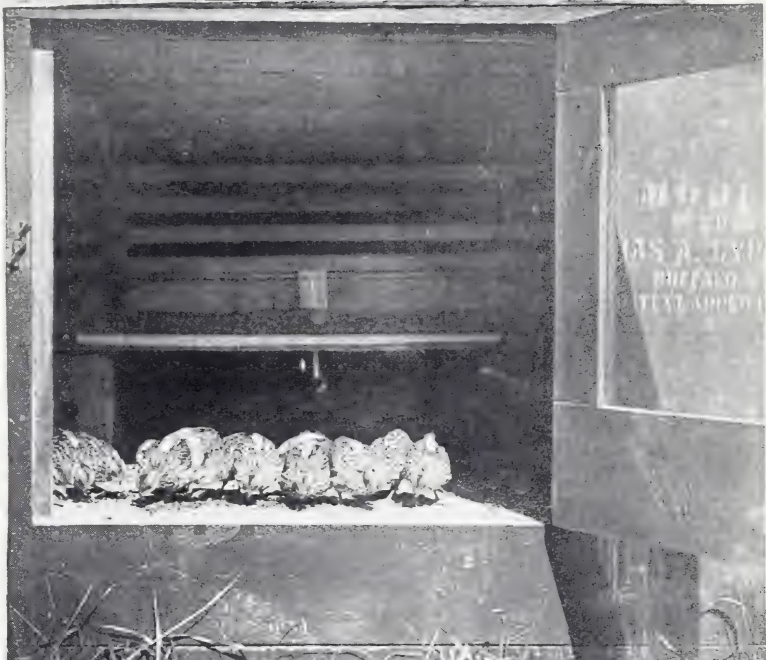
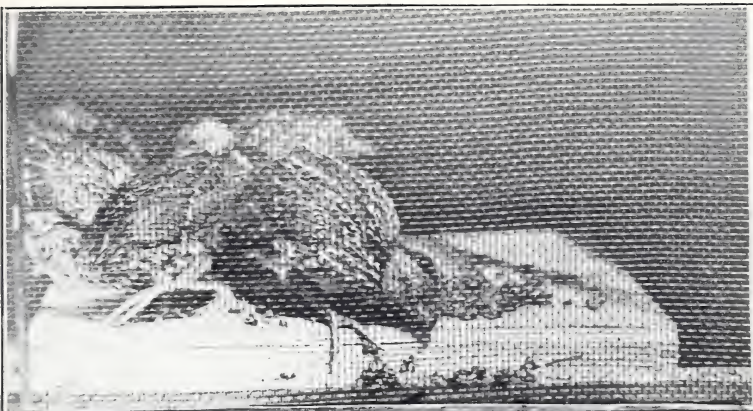
All vegetation about the grounds that is likely to yield any food has been protected and encouraged to grow, and plantations of promising kinds started. Further extensive plantings will be made of known valuable kinds, and new kinds tried as information can be secured about them, or stock obtained.



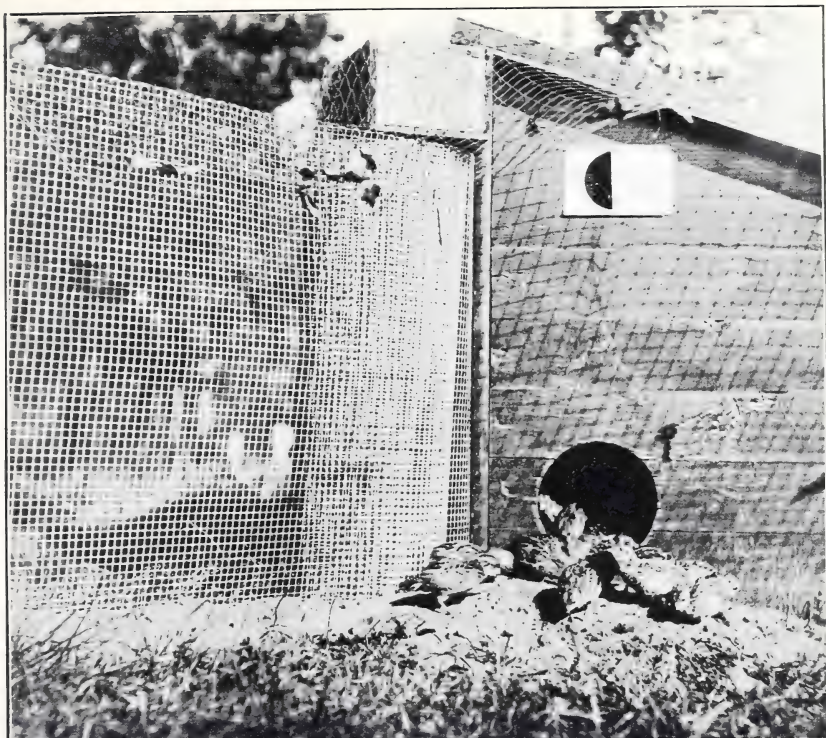
Upper portion of photograph, — one of the quails' nests built in our breeding pen.
Centre portion, — "just out." Lower portion, — "one day old."



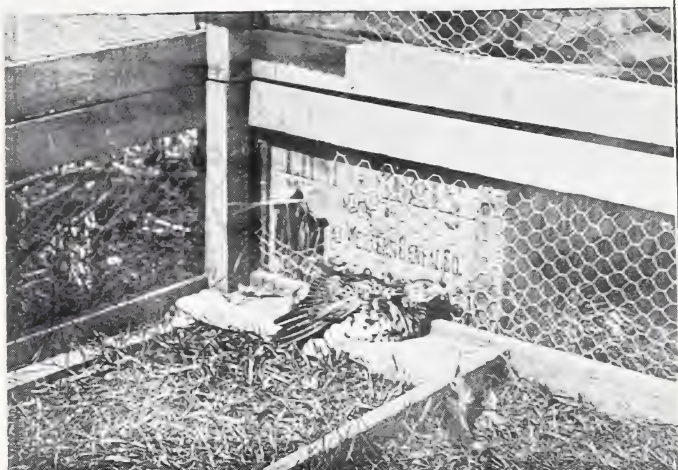
Quail hatched and reared in confinement. In first and second views, two days old; in third view, nine days old; in fourth and fifth views, fifteen days old.



Quail reared in confinement. In first view, fifteen days old. (See also other photographs of quail of same age.) In birds of this age note the longitudinal stripes on the feathers, similar to those of the adult migratory quail of Europe (*Coturnix coturnix*). In second view, eighteen days old; in third view, twenty-four days old.



Upper portion of photograph, — quail hatched and reared in confinement: birds in the yard, at entrance to brooder. Lower portion (from photograph by A. C. Hill, Belmont, Mass., June 7, 1906), — pheasant's nest, with ten young and two eggs.



Ruffed grouse, hatched and reared in confinement. Twelve weeks old. Showing condition at time of first moult, when the adult plumage is assumed.

Another experiment was made at Sharon, under the observation of the writer. Two lots of Alabama quail, a total of 68 birds, were placed in a pen containing 8,400 square feet, surrounded by a wire fence 5 feet high. Their wings were clipped, to prevent escape. The pens surrounded a patch of blueberry, sumach and barberry bushes, in a tangle of climbing bitter-sweet, where quail had formerly nested.

Some of the birds were undoubtedly infected by disease germs before arrival. In spite of all attentions and the best of feed, a disease appeared which manifested every symptom of chicken cholera, and the bacillus, which was pronounced by Dr. Tyzzer to be apparently the responsible agent, was described by him as very similar, if not identical, with that which is known to be the cause of chicken cholera.

The object was to feed and protect these birds and their progeny until such a time as the moulting renewed the flight feathers, when both old and young would gradually work out over the fences and seek the abundant rye, buckwheat and sumach which were accessible close by the pen. The ravages of the disease impaired the results, so that not more than 11 quail have been seen at one time. They are, however, so tame that it is difficult to flush them without a dog.

These observations, however, supplemented by reports which have reached us of the quail liberated through the efforts of the Massachusetts Fish and Game Protective Association, seem to indicate that with slight assistance Alabama quail may be able to establish themselves in Massachusetts.

In response to our inquiries, Mr. Goulding has sent us the following report of his experience with quail. It is possible that the loss of his birds can also be traced to parasites acquired from domestic poultry.

SOUTH SUDBURY, Nov. 19, 1906.

DEAR SIR:—Your letter of the 9th at hand, asking about raising quail. I got 15 eggs about four years ago; set them under a bantam hen. She got uneasy, and broke 3 of them. I put them under another bantam hen, and she hatched out 12, and they lived and grew fine until two-thirds grown; then 1 died, and the 11 lived to grow up, fine a lot of birds as you ever saw, until about the middle of November they began to die off. After losing about half, I let the rest go. I think, for one thing, my yard was rather small, and perhaps I fed them a little

too heavy. I fed them when they were young same as I fed my pheasants, which I have raised for six or seven years, — custard (unsweetened), maggots, fish worms, millet seed and grain. I had no trouble in raising them, but I had trouble in keeping them after they were full grown. I am in hopes to try them again some time.

Yours truly,

JOHN GOULDING.

Ruffed Grouse. — Attention has been called to the possibilities of rearing the ruffed grouse for distribution by the admirable work of Prof. C. F. Hodge of Clark University, Worcester, in which he succeeded in rearing this grouse from the egg to maturity for two successive generations in a small coop in a city yard. Professor Hodge has undertaken this work for the purpose of making a monograph on the ruffed grouse. In addition to his reports upon the progress of the work, which are to be found in the reports of the Commissioners on Fisheries and Game for the years 1904 and 1905, popular accounts also have been published in the "Country Calendar" for November, 1905, on "The Drumming of the Ruffed Grouse;" in "Country Life in America" for April, 1906, on "The Domestication of the Ruffed Grouse;" as well as in numerous other out-door and sporting magazines.

Mr. M. H. Coffin of Whitinsville, Mass., has also reared grouse in captivity in a brooder. He says, in a letter describing the results: —

The birds did well, grew very fast, were exceedingly tame, would fly on my head and shoulders, were all over me. After they were two-thirds grown they had my back lawn for a range, and ran around with the chickens. . . . When I got up one morning I found more than half of them dead, and the remainder died the next night. What caused their death I do not know; I am satisfied, however, that they got something which they should not have had. I am also satisfied in my own mind that if I should undertake another lot I would raise them, because I am satisfied that I should have placed them in a yard and put in at least 6 or 8 inches of wild leaf mould and loam, gathered from the woods, on top of the ground, so that they could not possibly come in contact with ground on which hens, chickens and dogs have run. They are surely the easiest kind of birds to tame, and the prettiest pets I ever had.

Though our first attempts at hatching and rearing ruffed grouse resulted in bringing only 3 birds to maturity, we gained

knowledge which promises to be of very great value for the future. In studying the question, the writer noticed that in all instances where the ruffed grouse died they were more or less associated with the hens or chickens. The suspicions aroused from this fact recalled some observations previously made at Kingston, R. I., and at Sharon, Mass., by Drs. Theobald Smith, Cooper Curtice, H. W. Marshall and the writer, upon the so-called "blackhead" disease of turkeys, which has practically precluded turkey-raising in Rhode Island, and which is now rapidly spreading to other sections of the country. Dr. Theobald Smith in 1895 discovered and described the microscopic animal, *Amœba melagroidis*, which as a parasite in the turkey causes characteristic lesions in the pyloric cæca and the liver, which are rapidly fatal. The original source and the entire life history of the parasite have not been discovered. Later, experiments and observations were made by the same persons at the Rhode Island Agricultural Experiment Station, for the purpose of ascertaining how this disease was transmitted. It was early learned that the parasites in the fæces of infected turkeys infected the ground and the drinking water. Hence it was believed that if poults could be hatched and brooded by hens infection would be avoided. The writer in 1902 hatched 16 turkey eggs in an incubator, and placed the poults brooded by hens upon a farm in Sharon where for many years no turkeys had been kept, either there or in the neighborhood. The poults, however, with two exceptions, died of the amœbic disease "blackhead." At the same time, and entirely independently, Dr. Cooper Curtice at Kingston, R. I., made similar experiments, in which poults reared on wooden floors to which poultry had never previously had access did not contract the "blackhead" disease, while those reared on ground where hens had run died in large numbers of "blackhead." These experiments and observations made it evident that the disease reached the poults either from an organism which lived a portion of its life in the earth, in the drinking water or upon vegetation, or else as a parasite of the domestic fowl.

The writer in 1898, assisted by H. W. Marshall, examined upwards of 3,000 incubator-hatched chickens which had died mostly within one week after hatching. Among these there

were not more than three or four which came at all under suspicion as infected by "blackhead." This made it seem probable that the disease-producing organism was not present in the chickens at hatching. When, however, the young ruffed grouse which had been reared by Dr. Hodge in an old hen yard and house died, the writer, on learning the symptoms, advanced the hypothesis that they may have become infected through the faeces of the hens which formerly occupied the place, and that they may have died of "blackhead;" so that, when the young ruffed grouse at Sutton died in a similar manner, and on post-mortem examination the characteristic inflamed and greatly enlarged pyloric caeca and the circular whitish spots on the liver were conspicuous, the dead birds were forwarded as quickly as possible to Dr. E. E. Tyzzer of the pathological department at the Harvard Medical School, who by microscopical examinations isolated the *Amœba melagroidis*, the specific organism which causes "blackhead," and confirmed the opinion. Since then we have been exceedingly careful not to permit the ruffed grouse to go upon ground where hens have run. Thus far, 3 grouse, regarding which every precaution has been taken to prevent access to ground where hens have ranged, have apparently escaped infection.

Similarly with the young quail, Dr. Tyzzer found the *Amœba melagroidis* in the intestine of a lot which was brooded by a hen. The mortality of quail was largely confined to this lot. As subsequent broods were transferred to new brooders as soon as hatched, the mortality from the amœbic disease was confined to those flocks which were either brooded by hens or placed upon ground where hens had previously run. Many adult quail were lost as a result of infection by the intracellular protozoan, *Coccidium avii*, with which the pheasants at Sutton were infected. From these observations it seems reasonably certain that these two parasites (and possibly others not yet discovered), to which hens and pheasants appear to be immune, attack not only the turkey but also the ruffed grouse (*Bonasa umbellus*) and the quail (*Colinus virginiana*) with particularly disastrous results, and that it is useless to attempt to rear either of these birds upon ground which has been used by hens or turkeys and pheasants (perhaps also guinea fowls, pigeons, ducks and geese).

It also opens up a long series of important questions. Possibly the fact that quail and ruffed grouse resort to hen yards for feed, where they may contract this or similar diseases, may be in part responsible for the present lack of quail. Perhaps this disease has killed more game birds than has the inclement weather and the cats. So, too, with the wild turkey and the heath hen. And what of the future? Caution, however, in dealing with our native birds is greater now than ever, and every well-wisher should more than ever discourage well-meaning but ill-advised attempts to rear quail and ruffed grouse under hens or in hen yards, or to attract such wild birds into areas occupied by domestic fowl.

That portion of the report by Arthur Merrill, superintendent of the State hatchery at Sutton, covering the rearing of ruffed grouse, follows:—

A total of 82 eggs of the ruffed grouse were received from various sections of the State at different times; all were placed under bantam hens, and hatched 70 strong, active, normal partridge chicks.

The first lot was hatched May 31, but were destroyed by a vicious hen. The second lot was hatched by a very careful hen, and suffered no loss for the first week, and none at all from any act of the hen; but from the second to the sixth week all but 2 died, from causes unknown, but supposed at the time to be effects of wrong feeding, though the most exact care in selecting and giving them food had no apparent effect in preventing the loss. Later, birds lost on the same ground and under exactly similar circumstances were found to have died of chicken cholera; and there seems to be no reason to doubt that this lot died of the same disease, except the last 2, which survived to be placed in a brooder, but soon after died of the amœbic disease. The third and fourth lots were hatched by hens possessed of a mania for scratching, and before the third day they began to kill the chicks by their violence in that work. A period of cold weather made the chicks seek them closely for shelter, but the hens scratched so persistently that the chicks were soon killed.

The fifth and sixth lots were hatched by a gentle hen, but cholera quickly attacked the chicks. When a Model brooder was procured, the survivors of these lots, numbering 7, were placed therein, and met with no loss for nearly a month, when they began to die of the amœbic disease. When they were reduced to 3, about two weeks later, the survivors were placed in a coop on fresh ground, and kept through the season.

The seventh lot hatched June 29, and the hen being exceptionally

gentle, she was allowed to keep them. They did well for a period, then 3 died of cholera; the other 3 were killed by the amœbic disease when about five weeks old. One in this lot, when but a few days old, broke its leg; but, as it seemed to be fully able to take care of itself, it was allowed to live, and so completely recovered that it could not be distinguished from the unhurt birds.

The grouse were fed on insect food, mainly aphids and leaf hoppers, as these were very abundant and easily obtained. Maggots were fed sparingly, green food freely, and mixed fine grain and seed with bread crumbs containing a fair percentage of bone and meat. This food was continued through the whole season, and with berries formed a large proportion of their food, so that after midsummer it seemed probable that only a slight amount of insect food or maggots need be used. Earth worms and white grubs were freely eaten, but this food was discontinued, as unsafe, the supply coming from ground where hen manure might have been used. Grass seed and grain sprouted in shallow boxes was eaten sparingly by young birds, though as they grew older they stripped their pen clean of all grasses and weeds. Lettuce grown in boxes was eagerly eaten by birds of all ages. This method of feeding proved very satisfactory, as a box with several days' supply could be put in the pen, and the last would be eaten as fresh as the first. For very young birds the boxes were placed in the shade before being fed. In the fall the great variety of fruit, berries and nuts then available was fed, and little was refused. Feeding the mature birds presents no difficulties, even if it is desired to use their natural food largely, for there is an abundance that can be easily collected, making the supply reliable and the cost not excessive.

Where natural food was used, considerable attention was devoted to the question of determining what kind of this food was practical for feeding on a more extensive scale; for, while the variety that can be used seems unlimited, comparatively little is available, especially of insect food, for feeding a large stock of birds, on account of the uncertain supply and cost of collection. The number of insects that can be used for feeding a small stock of birds is large; but it is doubtful if even the most abundant kinds could be relied upon to feed a large stock, except to give the youngest a start, and be replaced with a more certain supply of food, such as maggots or ant eggs. It is very probable that the question of food for the young grouse is not of the importance that it has seemed to be; for, if the loss of many birds was due to disease, as appeared from the post-mortem examination, and not to food, as was assumed at the time, then it will be found that little special feeding is necessary, and the care given other young birds, such as pheasants, will be sufficient.

Fruit and berries, both wild and cultivated, during the summer and fall form an important food that is easily obtained, and can be relied upon to supply any number of birds by cultivation. Custard was not

used, for fear of disease; but if the loss of young birds was due, as believed, chiefly to disease from hens, then it seems as though it would be safe to use custard, and with the birds accustomed to such food as this it would be easy to bridge over a scarcity of insect food.

LEGISLATION AND ENFORCEMENT OF LAWS.

Each year there is evident a commendable disinclination on the part of the Legislature to further cumber the statutes with special legislation. Indeed, much is being done annually to simplify the fish and game laws. There has developed a sturdy, wise and beneficial opposition to facile, ill-advised, special regulations. The questions are now studied in their broader bearing. Such action makes the laws more intelligible to the average citizen, and greatly facilitates their proper enforcement.

The fish and game laws are far too important in both their direct and indirect aspects upon the prosperity of the country, to the farmer, the rural citizen, to the urban dweller who depends upon the country for food and for recreation, or to the sea fisherman, the seashore property owner and the vacationist, or to the capitalist who invests brain, brawn or money in the seashore and inland fisheries, to allow unintelligent, personal, ill-digested or hasty formulation of regulations, or unintelligent, injudicious, malignant or blindly rigorous enforcement of the laws.

In general, the fish and game laws are directed: (1) to the benefit, maintenance and proper utilization of the natural yield of fish or game; (2) for the benefit of the farmer and fisherman who deal first hand with these products; (3) for the benefit of the public *i.e.*, the State, to whose continued well-being, physical, mental and moral, fish, flesh and fowl contribute in no insignificant degree; (4) towards those persons who are not citizens of the State, and who, though not paying direct taxes, still profit by the fish and game which are the property of the State.

The laws most difficult of satisfactory incidence are those belonging to the first group. Fishermen and hunters are too often actuated by selfishness, and notoriously destroy in order that another may not secure the booty. In such, too, selfish-

ness and improvidence are conspicuous and difficult of restraint. Lobster fishermen openly say that when the lobster is gone the men will take up some other kind of fishing. In a similar way, any regulation to protect the breeding fish, birds or mammals is met by strenuous opposition, each man seeking to combat to the utmost possible degree any interference with his own practices or convenience. Yet there has been an ever-growing necessity for intelligent restrictions, and there has been a marked development in the methods and practice of fish and game protection during the past seven hundred years or more, since King William the Lion, in 1175 A.D., in order that the salmon might have at least some opportunity to spawn, required that in Scotland no fish should be taken from sundown Saturday until sunrise of Monday; and that no nets, traps or other devices should be set in the middle of the stream; and the passage for fish is "aye to be so free sae muckle as a swine of 3 years olde well-fed is of length soe that neither the gronzie (snout) nor the tail may win tae ony side."

The farmer and the fisherman have strong legitimate rights, as the most important industrial classes, which the State must always recognize. The prosperity of the farmer and of the community rests ultimately upon agriculture; therefore, the birds, both game and insectivorous, must be protected and increased, in order that the ravages of insects and the noxious weeds may not impose too great a burden upon agriculture, and, through the increased cost of food, upon the entire community. Neither must the wild fox, cat, dog or other animal be permitted to destroy wild birds or poultry. The respective interests of the various members of the community in rabbits and deer, both of which may injure rural property, must be regulated with intelligence and justice. The rights of the farmer and of the fisherman to the products of their labor must be protected. Similarly, the rights of the laboring man and of the leisure class to proper participation in the enjoyment of certain privileges of fishing and hunting, to such a degree as not to seriously prejudice the rights of any other person, must be recognized and secured. Unfortunately, the rights of the State, or, in general, the public rights, often appear directly contrary to the interest of one or more classes of the community.



Upper portion of photograph,—nest and eggs of piping plover. The nests are numerous in suitable places, where there is no spring shooting. Lower portion,—nest and eggs of the least tern. This bird was nearly exterminated by the demand for its skin and wings for millinery purposes. One of the three or four remaining small colonies is in Massachusetts.

Yet, on the whole, the public interest must be paramount and must be sustained. The highest courts have decided that the wild fish, and shellfish, birds and mammals are the property of the State, and cannot be reduced to private possessions except under such definite regulations as the Legislature of the State may enact.

The Supreme Court of Iowa has publicly expressed the following opinion:—

The streams and lakes are the natural abiding places for the fish. In them they cast their spawn and multiply their species. They constitute an important and valuable article of diet for the rich and the poor, and, with the ways open that nature has provided, they are accessible to both. If the lowest riparian owner of a stream may legally block the way of their migration, the consequences to result to the thousands are readily imaginable. The law that would permit it would be the entering wedge by which the few would profit at the expense of the many.

Towards the people who are not citizens of the State, a minimum discrimination must be made in order to secure to those who pay taxes within the State the benefits which are justly theirs alone. Such instances are the law restricting hunting by unnaturalized foreign-born persons, which even in its present imperfect form has been of much benefit, and the laws in many States which compel non-residents to take out a license for hunting or fishing, or both.

Game.—The changing conditions between the relative abundance of the game and of the population in the various States has led to the adoption of some form of game license provision in all the States and Territories and British Provinces, excepting Massachusetts, Rhode Island, Connecticut, Georgia, Alabama, Texas, Oklahoma, Indian Territory, New Mexico, Nevada and Colorado.

Proper solution of the question in this State and the necessary adaptations to the conditions here lead us to present some of the arguments pro and con, for the purpose of bringing out an intelligent consideration of the question.

The most prominent advantages appear to be as follows:—

(1) If all persons who desire to hunt are required to secure registration from the town or city clerk where they pay taxes, such registration certificate to be shown when requested by the

owner or occupant of land or their agents upon which the hunter may be, or by a duly authorized State, county or town officer upon proof of this authority, any hunter having a certificate could be identified, and any hunter without such could be taken into custody, if necessary, to secure identification.

(2) Such provisions have been found to be of most benefit to the farmer and to the rural community, since it is these who suffer most from the depredation of irresponsible hunters and violators of the laws. Inasmuch as such a provision should be primarily designed for readily identifying the hunter, responsibility for untoward acts could be readily fixed. A knowledge of this fact, too, would without doubt exert a restraining influence over lawless individuals.

(3) A moderate fee should be imposed. The money paid into the treasury of the Commonwealth should provide a just compensation to farmers and land owners for damage done by deer, and for the maintenance and propagation of game and insectivorous birds.

(4) Such a system assesses the cost of protecting and propagating game and of enforcing the laws upon the persons who secure the most benefit, and who most make necessary the provisions for enforcement of the fish and game laws.

(5) The fish and game in Massachusetts is especially accessible on account of the extensive railroad and trolley facilities, while the character of the roads makes it possible to visit by automobile or even by bicycle several of the best hunting grounds in a day. Similarly, the character of the country, with its large cities and seaboard towns and villages, concentrates the game in rather definite localities, so that one who knows the country and habits of the game can seek the favorable localities, and be more certain to find game, than if the game was more widely scattered and in less accessible country. Moreover, there are parts of Massachusetts where great numbers of sea and river ducks, geese and brant resort. Ruffed grouse are to be found in such numbers that 12 to 15 birds a day is no unusual bag for a crack partridge man, and less than 3 or 4 birds for practised hunters is uncommon. There are many men who kill over 100 birds a year, and two men are known to us who killed 240 ruffed grouse this year. Deer are numerous in almost all

parts of the State. These facts seem to justify the opinion that a Massachusetts game license should offer exceptional facilities, on account of the variety and quantity of game, and its very exceptional accessibility to the man who can leave his vocation only for a day or two at a time during the hunting season.

(6) Such a method of dealing with the question would doubtless result in a restriction of the number of hunters to the more responsible persons, who are not so likely to be butchers rather than true hunters. It would thus indirectly increase the quantity of game available.

(7) It would facilitate the enforcement of law, by a provision which called for the forfeiture of a license if the possessor should violate the game laws, or if he was found hunting when in an irresponsible condition under the influence of liquor; and, further, if it made all persons who had been proved guilty of certain acts, contrary to law and order, or who were common drunkards, etc., or professional violators of law, totally ineligible for receiving such registration.

(8) It would increase the security of game birds against trappers, since persons who pay for hunting privileges are more likely to protect their own interests.

(9) It would develop a more intelligent public sentiment in favor of the useful birds and mammals.

(10) It would thus be of assistance in checking forest fires, since those who pay for the privilege of hunting would exercise more care for the preservation of the covers.

(11) Further, it might be made to furnish reliable statistical evidence of the number of persons who benefit by the game, and a fairly accurate knowledge of the economic value of the animal products of the land and water, in order that the value may be known and the yield of the unmarketable crops of game, *e.g.*, ruffed grouse, woodcock, etc., and of the results of methods which seek to maintain or to increase the quantity and quality, either by restrictive laws or by propagating or introducing certain species.

The experience of another year has still further demonstrated the undesirable conditions which may prevail under a law which exposes deputies appointed for the enforcement of law to the temptation of seeking prosecutions under the stimulus of half

the fine secured by their activity. Such a system is pernicious, and cannot fail to result in many instances of service discredited and justice prostituted. This commission, if it is to be held responsible for the enforcement of the fish and game laws, should be given an adequate force of properly paid men, who are chosen solely for their efficiency in the special work, and who are secure in their positions so long as they enforce the law with intelligence, impartiality and vigor, and maintain the service above suspicion. The present force of paid deputies includes such men, who are rendering honest, intelligent and active service, equal, if not superior, to that given by any similar body of men in any State. These deputies are one and all now working together as a unit with the commissioners to increase the total efficiency of the department. Our aim is to give the best service which can be developed with the means within our power. We have both paid and unpaid deputies who have spurned substantial bribes, who have risked their health by voluntary, prolonged exposure, who have not hesitated to risk life itself deliberately, in the performance of duty.

The year has been one of substantial progress in the enforcement of law. The total number of arrests was 296, and the total amount of fines imposed was \$3,316.55. Of this amount, \$2,785.55 was from arrests by paid deputies.

Of the fines imposed by unpaid deputies, \$531 was reported this year, compared with \$928.96 in 1905. We have reason to believe that not all the fines secured by unpaid deputies were reported to the commissioners, as we have no legal right to compel such reports, or to exercise other control over unpaid deputies than that of appointment and dismissal.

The following table indicates the number of prosecutions under the more frequent types of violation of the fish and game laws:—

*Classification of Arrests for Violations of the Fish and Game Laws
during the Year 1906.*

FORM OF VIOLATION.	Number of Cases.
Shellfish laws,	49
Sunday hunting,	88
Short lobsters,	35
Hunting without license,	29
Dogs chasing deer,	6
Illegal possession of game,	9
Killing song-birds,	16
Short trout,	12
Sawdust pollution,	5
Fishing closed ponds,	10
Short pickerel,	5
Pike perch,	6
Trout out of season,	1
Setting fish trap without permit,	1
Smelts in close season,	4
Shooting pheasants out of season,	3
Killing deer,	6
Using more than ten hooks,	6
Snaring game,	8
Short bass,	2
Taking game from State,	2
Possession of feathers of certain birds for millinery purposes,	2
Killing and possession of heron,	2
Hunting with ferret,	9
Buying partridge,	2

Classification of Arrests for Violations of the Fish and Game Laws during the Year 1906 — Concluded.

FORM OF VIOLATION.	Number of Cases.
Selling partridge,	2
Setting snares,	3
Scallops in close season,	1
Trapping fish,	1
Taking scallops less than 2 inches,	2
Total number of counts,	327

Fish and Game Laws and their Enforcement.—Summary of Law-enforcement Work during the Year 1906.

Total fines imposed,	\$3,316 55
Fines from arrests by paid deputies,	2,785 55
Fines from arrests by unpaid deputies,	531 00
Total number of counts taken to court,	327
Total number of persons arrested,	296
Convictions,	286
Discharged,	37
Defaulted,	4
Cases filed,	39

Practical experience with the law which applies to dogs running deer indicates that it is rather cumbersome, and entails an excessive amount of investigation in cases where certain dogs are notoriously kept solely for the purpose of chasing deer.

The lobster law as it stands at present cannot from the nature of the conditions be enforced. It appeals neither to the common sense of the fishermen nor to the demands of the market; neither, if it could be properly enforced at a reasonable expense, can it be expected to meet the requirements for protecting the lobster to a degree sufficient to adequately ensure the future of the commercial fishery. Indeed, it is a question whether this law may not have done more than have illegal fishermen in depleting the supply.

There were this year 35 arrests for possession of short lobsters, compared with 22 in 1905.

It is a most significant fact, in connection with the fines imposed in Massachusetts, that in New York State 232 convictions paid fines to the amount of \$13,204.07, the average fine being \$56.91; in New Jersey, \$29.84; while the average fine in Massachusetts was but \$11.66 for a similar class of violations of the fish and game laws.¹ If the fines for violation of the lobster law, for the killing of birds, and for hunting without a license, were considerably increased, the effect would be most salutary.

There is a feature of the Lacey act which is very frequently overlooked by persons carrying or shipping game from one State to another; viz., that game killed legally in one State and transported to another becomes subject to the law of the State into which it is transported; *e.g.*, wood duck shipped from New Hampshire to Massachusetts must be considered here exactly as if it were killed in Massachusetts. Further, our State laws prohibit the shipment or carrying of quail, partridge and wood duck out of the State. Sporting clubs which lease grounds in this State would save probable annoyance to members and friends if the obvious sentiment of the club showed greater respect for this law.

The laws of all States, Territories and Provinces in North America, except Alabama, prohibit the shipment of quail, prairie chickens and other birds from those States, so that the buyers may be reasonably certain that in purchasing such birds they are compounding a felony.

Birds used for Millinery.—One of the far-reaching results of the movement for the protection of non-game birds has been the elimination of the plumage of native species from the millinery trade. This has been accomplished partly by legislation prohibiting possession and sale of such plumage, and partly by co-operation between the Audubon societies and the principal wholesale milliners of the country. In 1903 agreements were made between the Audubon societies of several of the eastern States and the Merchants' Millinery Protective Association of New York, and also between several of the

¹ Compare with the average in Montana, \$88.20 for 1904.

societies in the west and the Western Jobbers' Association, whereby the sale of plumage of gulls, terns, grebes and other native birds was discontinued. These agreements originally ran for three years, but in 1905 those of the western association were renewed. At the present time comparatively few native birds are killed in the United States for millinery purposes, and the radical change from the well-known conditions of a few years ago has been brought about without serious loss to the trade. But, if the sale of those already killed should be permitted, the collectors would be again stimulated to resume the slaughter.

The milliners, both the wholesale and retail, have in general respected the law. In some instances they have been wilfully misled by salesmen of New York houses, who falsely claimed that the goods offered were "manufactured." When told by our deputies that these same feathers were undoubtedly genuine, and that the possession of such "aigrettes" or other feathers made them liable to a fine of \$10 for each bird or each part thereof, an agreement was made to return them to the wholesalers. In only two instances was it necessary to carry feather cases to the courts. In each of these cases convictions followed for the possession of parts of gulls and of parts of herons ("aigrettes").

A third line of effort, in which this commission has attempted to support the Audubon societies, has been the restriction of the traffic in native cage birds. Thousands of mockingbirds, cardinals, indigo birds and other bright-plumaged species were formerly trapped for sale in this country and abroad; and so assiduously did the bird trappers ply their vocation that in some localities these species were almost exterminated. New Orleans was one of the chief centers of shipment; but, with the passage of a law in Louisiana in 1904 prohibiting sale and shipment of birds, this source of supply was cut off, and the effect of the law has been felt in several of the larger cities of the country. How great the progress has been can readily be understood by comparison with conditions abroad. No other country at present extends such complete protection to its non-game birds, or has restricted the traffic in native birds more effectively than the United States. But unremitting vigilance is necessary to maintain this condition.

NEW LEGISLATION.

We respectfully recommend the passage of laws designed to accomplish the following purposes:—

Increase the number of deputies for the enforcement of the fish and game laws.

Modify the lobster law for the purpose of increasing its efficiency for the economic utilization of lobsters as food, and devise a law that may be economically and strictly enforced.

Increased powers to deputies, in order that they may have the same rights in enforcing the fish and game laws that the District Police have in enforcing the general laws.

And, further, that some provision be made whereby deputies may be able to ascertain the variety of game birds and fish in the possession of persons suspected of violating the law.

Deputies should be required to fulfil certain duties connected with the prevention of brush and forest fires.

Appropriate legislation relating to the shooting of deer and birds by persons not citizens of the State, as well as by citizens.

An act to protect property from damage by deer.

A law to prevent the liberation of injurious carnivorous animals in the State.

A resolve for compensation of Adam J. Rausch, who was injured while in the service of the State as fish and game deputy.

An amendment of chapter 91, section 132, relative to fishing with seines, dip nets, etc., in fresh water.

An amendment to section 19, chapter 91 of the Revised Laws, so as to make the mayor and aldermen of a city, or the selectmen of a town, the petitioners for the stocking and closing of great ponds.

Protection of Bartramian sandpiper, Eskimo curlew and killdeer plover, which have suffered severely through certain natural causes, and which, unless protected, are likely to become extinct; and also for the protection of certain useful birds of prey.

The protection and permanent maintenance of the pinnated grouse (heath hen), and the terns, black-backed and herring gulls.

Action towards making the fish and game laws uniform throughout the State.

An amendment of the law concerning the disposal of fines and forfeitures incurred under the laws relating to birds, mammals and game.

The abolition of spring shooting, in order that the number of birds remaining in the State to breed may be increased.

The prohibition of the hunting of rabbits after January 1 on Martha's Vineyard.

The prohibition of the sale of lobster meat removed from the shell at any considerable distance and at any considerable time previous to consumption, in order that the lobster laws may be better enforced and the public health more adequately safeguarded.

Such legislation as may make possible the rehabilitation of the shad fishery in Massachusetts.

Section 66, chapter 91 of the Revised Laws, should be amended by striking out the words "February and March," in the third line, and substituting therefor the words February 1 to April 15.

An amendment of the law relating to pollution of streams by sawdust.

An amendment of the law relating to seed scallops.

COURTESIES.

It is a pleasure again to acknowledge the assistance so courteously rendered to the commission by Mr. Arthur L. Millett, local agent of the United States Bureau of Fisheries at Gloucester, and by Mr. F. F. Dimick, the efficient secretary of the Boston Fish Bureau.

Permits to hold in confinement egg-bearing lobsters for collection by the agents of this commission, according to chapter 408, Acts of 1904, were issued to 234 fishermen.

Permits for taking birds and eggs under section 7, chapter 92 of the Revised Laws, as amended by chapter 287, Acts of 1903, were issued to the following-named persons:—

Frank S. Aiken, Fall River.
 Frederick E. Waterman, Fall River.
 Chester A. Reed, Worcester.
 Robert O. Morris, Springfield.
 John W. Bailey, Boston.
 Owen Durfee, Fall River.
 A. H. Tuttle, Cambridge.
 Rufus Choate Currier, Newburyport.
 Haynes H. Chilson, Northampton.
 John H. Hardy, Jr., Boston.
 A. C. Bent, Taunton.

Fred H. Kennard, Brookline.
 E. H. Forbush, Wareham.
 William Dearden, Springfield.
 F. B. McKechnie, Boston.
 Alfred E. Preble, No. Parsonfield, Me.
 Homer L. Bigelow, Boston.
 William Brewster, Concord.
 George M. Gray, Woods Hole.
 J. A. Sinclair, Wilmington.
 Seth A. Borden, Fall River.
 F. H. Carpenter, Seekonk.

Permit to take ruffed grouse eggs for experiments in propagation was issued to:—

Dr. C. F. Hodge, Worcester.

Permit to use in Edgartown Channel and along the shores of Chappaquiddic Island a small-mesh seine for scientific purposes, only, was issued to:—

Osborn Marcus Curtis, New Brighton, N. Y.

Permits to take sand eels for bait, under chapter 164, Acts of 1902, were issued to the following persons:—

John W. Post, Ipswich.
 Peter Rhodes, Ipswich.
 James A. Carter, Ipswich.
 Joseph Thurlow, Newburyport.
 John T. Riley, Ipswich.

William Crooks, Newburyport.
 James Crooks, Newburyport.
 Henry L. Godfrey, Newburyport.
 Charles E. Kent, Newburyport.
 Edward L. Perkins, Newburyport.

Permits for taking lamprey eels for scientific purposes were issued to:—

William Patten, Hanover, N. H. (Dartmouth College).
 George M. Gray, Woods Hole (Marine Biological Laboratory).

Permit to operate fyke nets in Waquoit Bay, for fish-cultural purposes, was issued to:—

E. F. Locke, United States Fisheries Station, Woods Hole.

Permits to hold in confinement, for purposes of propagation, live quail, under chapter 406, Acts of 1905, were issued to:—

Eugene D. Whiting, Bridgewater.
 George M. D. Gardinier, Wellfleet.

J. N. Dummer, Rowley.

Permit to hold black bass, trout and pickerel of any size, at any season, and to use a casting net and minnow traps for purposes of study only, was issued to:—

W. Endicott Dexter, Boston.

Permit to take and have in possession quail, partridge and prairie hen, for purposes of propagation, was issued to:—

Seth A. Borden, Fall River.

GEORGE W. FIELD.
EDWARD A. BRACKETT.
JOHN W. DELANO.

APPENDICES.

[A.]

LIST OF COMMISSIONERS.

UNITED STATES BUREAU OF FISHERIES, WASHINGTON, D. C.

George M. Bowers, Commissioner.

Hugh M. Smith, Deputy Commissioner.

Irving H. Dunlap, Chief Clerk.

John W. Titcomb, Assistant in charge of Division of Fish Culture.

Barton W. Everman, Assistant in charge of Division of Inquiry Respecting Food Fishes.

A. B. Alexander, Assistant in charge of Division of Statistics and Methods.

Hector Von Bayer, Architect and Engineer.

Superintendents of United States Fisheries Stations.

E. E. Race, Green Lake, Me.

Charles G. Atkins, Craig Brook, East Orland, Me.

W. F. Hubbard, Nashua, N. H.

E. N. Carter, St. Johnsbury, Vt.

C. G. Corliss, Gloucester, Mass.

E. F. Locke, Woods Hole, Mass.

Chester K. Green, Cape Vincent, N. Y.

L. G. Harron, Bryant Point, Md.

George A. Seagle, Wytheville, Va.

R. K. Robinson, White Sulphur Springs, W. Va.

J. J. Stranahan, Cold Springs, Bullochville, Ga.

G. H. H. Moore, Tupelo, Miss.

S. G. Worth, Edenton, N. C.

S. W. Downing, Put-in-Bay, O.

Frank N. Clark, Northville, Mich.

S. P. Wires, Duluth, Minn.

S. P. Bartlett, Quincy, Ill.

R. S. Johnson, Manchester, Ia.

H. D. Dean, Neosho, Mo.

J. L. Leary, San Marcos, Tex.

W. T. Thompson, Leadville, Col.

D. C. Booth, Spearfish, S. D.

James A. Henshall, Bozeman, Mont.

G. H. Lambson, Baird, Cal.

J. N. Wizner, Clackamas, Ore.

Henry O'Malley, Baker Lake, Wash.

Claudius Wallich, Yes Lake, Alaska.

M. F. Stapleton, Mammoth Spring, Ark.

ARIZONA.

Fish and Game.

T. S. Bunch,	.	.	.	.	.	.	Safford.
W. L. Pinney,	.	.	.	.	.	.	Phoenix.
Jean Allison,	.	.	.	.	.	.	Jerome.

CALIFORNIA.

W. W. VanArsdale, President,	.	.	.	.	.	San Francisco.
W. E. Gerber,	.	.	.	.	.	Sacramento.
John Birmingham, Jr.,	.	.	.	.	.	Pinole.
Charles A. Vogelsang, Chief Deputy,	.	.	.	.	.	San Francisco.

COLORADO.

J. M. Woodard, Commissioner,	.	.	.	.	Denver.
R. L. Spargur, Chief Clerk,	.	.	.	.	Denver.
W. S. Kincaide, Superintendent Hatcheries,	.	.	.	.	Denver.

CONNECTICUT.

George T. Mathewson, President,	.	.	.	.	Thompsonville.
E. Hart Geer, Secretary,	.	.	.	.	Hadlyme.
Robert G. Pike,	.	.	.	.	Middleton.

DELAWARE.

A. D. Poole, President,	.	.	.	.	Wilmington.
E. G. Bradford, Jr., Secretary and Treasurer,	Wilmington.

FLORIDA.

Honorary Fish Commissioner.

John Y. Detwiler,	New Smyrna.
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GEORGIA.

A. T. Dallis,	LaGrange.
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IDAHO.

William N. Stephens,	Boise.
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ILLINOIS.

State Game Commissioners.

John A. Wheeler,	Springfield.
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Board of Fish Commissioners.

Nat H. Cohen, President,	Urbana.
S. P. Bartlett, Superintendent and Secretary,	Quincy.
Henry Kleine,	.	.	.	.	Chicago.

INDIANA.

Z. T. Sweeney, Commissioner, Columbus.
 E. E. Earle, Chief Deputy, Indianapolis.

IOWA.

Fish and Game Warden.

George A. Lincoln, Cedar Rapids.

KANSAS.

D. W. Travis, Pratt.

MAINE.

Inland Fisheries and Game.

L. T. Carleton, Chairman, Winthrop.
 J. W. Brackett, Phillips.
 Edgar E. Ring, Orono.

Sea and Shore Fisheries.

A. R. Nickerson, Boothbay Harbor.

MARYLAND.

Fisheries Commissioners.

James D. Anderson, Somerset County.
 Charles F. Brooke, Montgomery County.

State Game and Fish Warden.

Col. John W. Avirett, Cumberland.

Assistant Warden.

Oregon Milton Dennis, Baltimore.

MASSACHUSETTS.

George W. Field, Chairman, Boston.
 Edward A. Brackett, Winchester.
 John W. Delano, Marion.

Office, State House, Boston.

MICHIGAN.

Fish Commissioners.

Freeman B. Dickerson, Detroit.
 George M. Brown, Saginaw.
 Charles D. Joselyn, Detroit.

Game and Fish Warden.

Hon. Charles H. Chapman, Sault Ste. Marie.

MINNESOTA.

O. J. Johnson, President, St. Paul.
 Carlos Avery, First Vice-President, St. Paul.
 John H. Grill, Second Vice-President, St. Paul.
 H. G. Smith, Secretary, St. Paul.
 S. G. Fullerton, Executive Agent, St. Paul.

MISSOURI.

Joseph H. Rodes, Sedalia.

MONTANA.

State Game and Fish Warden.

William F. Scott, Helena.

NEBRASKA.

Gov. George L. Sheldon, Lincoln.
 George L. Carter, Chief Deputy, Lincoln.

NEW HAMPSHIRE.

Nathaniel Wentworth, Chairman, Hudson Centre.
 Charles B. Clarke, Financial Agent, Concord.
 Merrill Shurtleff, Secretary, Concord.

NEW JERSEY.

Benjamin P. Morris, President, Long Branch.
 Richard T. Miller, Camden.
 David P. McClellan, Morristown.
 Percy H. Johnson, Bloomfield.

NEW MEXICO.

W. E. Griffin, Santa Fé.

NEW YORK.

Forest, Fish and Game Commission.

James S. Whipple, Commissioner, Salamanca.
 J. Duncan Lawrence, Deputy, Bloomville.
 John D. Whish, Secretary, Albany.

Shellfish Commissioner.

B. Frank Wood, New York.

NORTH DAKOTA.

District Game Warden.

F. W. Schelchter, District No. 1,	.	.	.	Fessenden.
William McKean, District No. 2,	.	.	.	Sanborn.

OHIO.

Commissioners of Fish and Game.

Paul North, President,	.	.	.	.	Cleveland.
Thomas B. Paxton,	.	.	.	.	Cincinnati.
J. F. Rankin,	.	.	.	.	South Charleston.
D. W. Greene,	.	.	.	.	Dayton.
George W. McCook,	.	.	.	.	Steubenville.
George C. Blanckner, Secretary,	.	.	.	.	Columbus.
J. C. Porterfield, Chief Warden,	Columbus.

OKLAHOMA.

Territorial Game and Fish Warden.

Eugene Watrous,	Enid.
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OREGON.

Master Fish Warden.

H. G. VanDusen,	Astoria.
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Game and Forestry Warden.

J. W. Baker,	Cottage Grove.
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PENNSYLVANIA.

Game Commissioners.

James H. Worden, President,	Harrisburg.
C. K. Sober,	Lewisburg.
William H. Myers,	.	.	.	.	Williamsport.
Charles B. Penrose,	.	.	.	.	Philadelphia.
Frank G. Harris,	.	.	.	.	Clearfield.
John M. Phillips,	.	.	.	.	Pittsburg.
Dr. Joseph B. Kalbfus, Secretary,	Harrisburg.

Department of Fisheries Commissioner.

W. E. Meehan,	Harrisburg.
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Board of Fishery Commission.

John Hamberger,	Erie.
Henry C. Cox,	Wellsboro.
Andrew R. Whitaker,	Phoenixville.
W. A. Leisenring,	.	.	.	.	Mauch Chunk.

RHODE ISLAND.

Commissioners of Inland Fisheries.

Henry T. Root, President,	.	.	.	.	Providence.
William P. Morton, Secretary,	.	.	.	.	Johnston.
J. M. K. Southwick,	.	.	.	.	Newport.
Charles W. Willard,	.	.	.	.	Westerly.
Adelbert Roberts,	.	.	.	.	Woonsocket.
Albert Davis Mead,	.	.	.	.	Providence.
William H. Boardman,	.	.	.	.	Central Falls.

Commissioners of Shell Fisheries.

James M. Wright,	.	.	.	.	South Scituate.
Herbert M. Gardiner,	.	.	.	.	Barrington.
Philip H. Wilbour,	.	.	.	.	Little Compton.
George W. Hoxie,	.	.	.	.	Charlestown.
James H. Northup,	.	.	.	.	Warwick.
James C. Collins, Clerk,	.	.	.	.	North Providence.

Commissioners of Birds.

John H. Flanagan, Chairman,	.	.	.	.	Providence.
W. Gordon Reed, 2d,	.	.	.	.	Coweset.
E. R. Lewis,	.	.	.	.	Westerly.
William H. Thayer,	Bristol.
A. O'D. Taylor,	Newport.

TENNESSEE.

State Warden.

Joseph H. Acklen,	Nashville.
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UTAH.

John Sharp,	Salt Lake City.
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VERMONT.

H. G. Thomas,	Stowe.
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WASHINGTON.

John L. Riseland,	Bellingham.
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WEST VIRGINIA.

Game and Fish Warden.

James H. Marcum,	Huntington.
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Special Deputy.

F. H. Merriek,	Huntington.
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WISCONSIN.

State Warden.

Jonas Swenholt, Madison.

Commissioners of Fisheries.

The Governor, Ex Officio.

Calvert Spensley, President, Mineral Point.
James J. Hogan, Vice-President, LaCrosse.
E. A. Birge, Secretary, Madison.
William J. Starr, Eau Claire.
Henry D. Smith, Appleton.
Jabe Alford, Madison.
A. A. Dye, Madison.
James Nevin, Superintendent, Madison.

[B.]

DISTRIBUTION OF FOOD FISH.

BROOK TROUT.

Fry distributed from the Adams Hatchery during April and May, 1906.

APPLICANT.	Name of Brook.	Town.	Number.
Frederick S. Williams.	Main,	Lanesborough, . .	5,000
Frederick S. Williams.	Pratt,	Lanesborough, . .	5,000
Frederick S. Williams.	Northup,	Lanesborough, . .	5,000
Frederick S. Williams.	Scott and Mudge,	New Ashford, . .	10,000
A. W. Palmer,	Gibbs,	Otis,	5,000
James H. Krum, Jr.,	Hudson,	Clarksburg, . .	5,000
James H. Krum, Jr.,	North Branch,	North Adams, . .	5,000
James H. Krum, Jr.,	Tunnel,	North Adams, . .	5,000
James H. Krum, Jr.,	Sherman,	North Adams, . .	5,000
William F. Card,	—	—	5,000
William P. Martin,	Fiske,	Adams,	5,000
George F. Sayles,	Dry,	Adams,	5,000
Harry J. Sheldon,	Bassett,	Adams and Cheshire,	5,000
James M. Burns,	Sackett,	Pittsfield,	10,000
James M. Burns,	Hollow and Wells,	Pittsfield,	
James H. O'Hara,	Patter,	Greenfield,	
James H. O'Hara,	Casey,	Bernardston,	
Sigmond Klaiber,	Dry and Fall River,	Turner's Falls,	15,000
W. E. Hoyt,	Broad,	Williamstown,	10,000
Charles T. Bangs,	Cherry Run,	Greenfield,	5,000
Joseph D. Fontaine,	Peck,	East Shelburne,	5,000
Chas. H. Robertson,	Hibbard,	Leyden,	5,000
F. G. Creamer,	Tuttle,	Peru,	5,000
F. G. Creamer,	Fuller,	Peru,	5,000
C. L. Fisher,	Blacksmith,	South Deerfield,	5,000
W. P. Shunway,	Mosquito Factory,	Warwick,	5,000
A. F. Pierce,	Westfield River,	Chester,	5,000
Henry E. Day,	Middle Branch Westfield River,	Dayville,	5,000
Alfred Read,			
Harry H. Smith,			
F. H. Saunders,			
W. J. Morton,			
C. L. Haughton,			
L. C. Coburn,	Powder Mill, Timber Swamp,	Westfield,	40,000
Leon H. Bowers,	Munn's,		
F. T. Gridley,			
C. L. Kites,			
Robert L. Soper,			
Wm. G. Soper,			
Edward G. Clark,			
Joel Martin,	Little River,	South Worthington,	5,000
Joel Martin,	Middle branch Westfield River,	West Worthington,	5,000
Rufus Adams,	Kinney,	Worthington,	5,000
			225,000

Fry distributed from the Hadley Hatchery during April and May, 1906.

Harrison E. Dunbar,	Buttery,	South Hadley,	3,000
F. E. White,	Leaping Well,	South Hadley,	3,000
A. W. Hoffman,	Leaping Well,	South Hadley,	3,000

Fry distributed from the Hadley Hatchery, etc.—Concluded.

APPLICANT.	Name of Brook.	Town.	Number.
Edgar T. Harris, .	Buttery,	Seuth Hadley, .	3,000
F. M. Smith, . . .	Stony,	South Hadley, .	3,000
Martinus Madsen, .	Stony,	South Hadley, .	3,000
A. M. Lyman, . . .	Wash-house,	Montague, . . .	3,000
M. W. Smith, . . .	Highland,	Goshen,	3,000
W. A. Smith, . . .	Hampshire,	Goshen,	3,000
F. E. Hawks, . . .	Rogers,	Goshen,	3,000
John Doherty, . . .	Packard,	Goshen,	3,000
T. F. Ahearn, . . .	Ahearn,	Sunderland, . . .	6,000
Edw. J. Brannigan, .	Flat,	Ware,	3,000
J. K. Murphy, . . .	Newton,	Hardwick,	3,000
J. W. Jackson, . . .	Olds,	Belchertown, . . .	3,000
Frank Shaughnessy, .	Mosquito Hollow, . .	Northampton, . .	3,000
Mathew Grogan, . .	Welch,	Sunderland, . . .	3,000
Peter McHugh, . . .	Running Gutter, . . .	Hatfield,	3,000
W. A. Sheldon, . . .	Broad,	Northampton, . .	3,000
Edward Miller, . . .	Roberts' Meadow, . .	Northampton, . .	3,000
William H. Feiker, .	Loudville,	Westhampton, . .	3,000
Louis F. Gaylor, . .	Parsons,	Northampton, . .	3,000
C. M. Pettingill, . .	Shaw,	Plainfield,	3,000
C. M. Pettingill, . .	Mitchell,	Plainfield,	3,000
C. M. Pettingill, . .	Clark,	Plainfield,	3,000
C. M. Pettingill, . .	Kimpen,	Plainfield,	3,000
			81,000

Fry distributed from the Sutton Hatchery during April and May, 1906.

Chas. N. Hargraves, .	Pod Meadow,	Framingham, . . .	10,000
W. F. Durgin, . . .	Streeter,	Northbridge, . . .	10,000
George B. Treen, . .	Lowland,	Mansfield,	10,000
C. F. Cowdry, . . .	Bixby Branch,	Townsend,	20,000
C. F. Cowdry, . . .	Bixby Branch,	Townsend,	
H. E. Cowdry, . . .	Bixby Branch,	Townsend,	
J. E. Stuart,	Bigelow Hill,	Westminster, . . .	20,000
John W. Hunting, . .	Mare Meadow,	Westminster, . . .	
G. L. Dawley, . . .	Mare Meadow,	Westminster, . . .	
C. H. Mansur,	Bigelow Hill,	Westminster, . . .	10,000
Rufus B. Dodge, . .	Holden Reservoir, . .	Holden,	
P. S. Callahan, . . .	Clay,	Sturbridge,	
Alex. T. Brown, . . .	Caswell,	Sutton,	5,000
Elmer A. Macker, . .	Bummit,	North Grafton, . .	10,000
William L. Taft, . . .	Poor Farm,	Northbridge, . . .	5,000
George L. Gill, . . .	Carpenter,	Northbridge, . . .	5,000
A. S. Noyes,	Burt,	Northbridge, . . .	5,000
William E. Johnson, .	Burt,	Northbridge, . . .	5,000
J. F. Despeaux, . . .	Mill,	Upton,	5,000
Edward E. Whiting, .	Mechanic Street, . . .	Upton,	5,000
Henry W. Rogers, . .	Maroney,	Upton,	5,000
Patrick Shaughnessy, .	Bernards,	Upton,	5,000
H. O. Elliott,	Branch Nashua River, .	South Ashburnham, .	10,000
D. H. Gates,	Poor Farm,	Gardner,	5,000
J. B. Mayo,	Poor Farm,	Gardner,	5,000
C. Fred Morse, . . .	Wilder,	Gardner,	5,000
A. W. Pratt,	Bailey,	Gardner,	5,000
Horace H. Ramsey, . .	Middle Branch,	New Salem,	20,000
Alfred S. Hunt, . . .	Swift River,	New Salem,	
Charles B. Adams, . .	Potash and Brown, . .	Webster,	
Charles B. Adams, . .	Sucker and Rocky, . .	Webster,	20,000
J. C. McMullen, . . .	Mulpus,	Lunenburg,	10,000
H. J. Cahill,	Capen's,	Randolph,	5,000
John Haney,	Narroway,	Randolph,	5,000
William F. Bartlett, .	Hillside,	Randolph,	5,000
Walter A. Chandler, .	Cemetery and Burnham, .	Lawrence,	20,000
W. J. Spranger, . . .	Town Farm,	Methuen,	
Joseph Rudolph, . . .	Hunting House,	Taunton,	
Joseph Rudolph, . . .	Chase,	Taunton,	10,000
Charles A. Gaudette, .	—	—	5,000
Nathan D. Chace, . .	—	—	5,000
Dana C. Everett, . . .	—	—	5,000

Fry distributed from the Sutton Hatchery, etc. — Concluded.

APPLICANT.	Name of Brook.	Town.	Number.
J. B. Valentine, . . .	— — —	— —	5,000
William Mitchell, . . .	— — —	— —	5,000
I. W. Gardner, . . .	— — —	— —	5,000
M. E. Leahy, . . .	Clear,	Randolph, . . .	5,000
Leominster Sports- man's Association, {	Keyes and Lynes, . . .	Sterling, . . .	25,000
William R. Traill, . . .	Pottery and Chocsett, . . .		
Clement E. Bill, . . .	White,	West Brookfield, . . .	10,000
			335,000

Fry distributed from the Winchester Hatchery during April and May, 1906.

Carl Farnsworth, . . .	Sawmill,	Medway,	5,000
Clyde C. Hunt, . . .	Black Swamp,	Medway,	5,000
J. J. Kennedy, . . .	Dead Meadow,	Stoughton,	5,000
Walter H. Butterfield, . . .	Lee,	Fall River,	14,000
Smith Finney, . . .	Rocky,	South Acton,	5,000
Smith Finney, . . .	Taylor,	South Acton,	5,000
Charles S. Baker, . . .	Bourne's,	Falmouth,	5,000
John H. Sweetser, . . .	Kendalls,	Woburn,	5,000
Luke D. McDermott, . . .	Crosby's,	Billerica,	5,000
Lewis A. White, . . .	Bennett,	Burlington,	5,000
Charlie A. Jones, . . .	Shaker Glen,	Woburn,	5,000
C. C. Taylor, . . .	Parker,	Bedford,	5,000
P. A. Caulfield, . . .	Walker's,	Burlington,	5,000
John H. Garvey, . . .	Carter,	North Woburn,	5,000
C. E. Taylor, . . .	Vine,	Bedford,	5,000
W. J. Hammond, . . .	Cutler's,	Woburn,	5,000
Frank W. Ames, . . .	McManus,	Woburn,	5,000
C. W. Ames, . . .	Bautwell Place,	Woburn,	5,000
George V. Lewis, . . .	Hall's,	Woburn,	5,000
M. E. S. Clemons, . . .	Skug River,	North Reading,	5,000
Arthur E. Roberts, . . .	Mack's and Newhouse,	Reading,	5,000
R. F. Loring, . . .	Sweetwater,	Reading,	5,000
Fergus A. Butler, . . .	Fish,	Boxford,	10,000
Claude H. Tarbox, . . .	Wheeler,	Newbury,	5,000
Seth Damon, . . .	Old Swamp,	Weymouth,	5,000
William K. Cole, . . .	Rock,	Boxford,	5,000
William E. Badger, . . .	— — —	— — —	5,000
Southwell Farrington, . . .	Long Meadow,	Tewksbury,	5,000
A. D. Wheeler, . . .	Pine Tree,	Milton,	5,000
Warren H. Beede, . . .	Law,	Lynnfield,	10,000
George W. Field, . . .	— — —	Sharon,	5,000
			174,000

Fingerling Trout Plants during Fall of 1906.

APPLICANT.	Name of Brook.	Town.	Brook Trout.	Rainbow Trout.
Sanborn G. Tenney, . . .	Hemlock,	Williamstown, . . .	500	—
W. K. Henry, . . .	Sackett and Leslie,	Pittsfield,	1,000	—
William H. Cooper, . . .	Cleveland,	Dalton,	250	—
John H. Bellows, . . .	Cady,	Dalton,	250	—
C. B. Wells, . . .	Kittredge,	Dalton,	250	—
H. A. Barton, . . .	Brown and Barton,	Windsor,	250	—
Joe Bissaillon, . . .	— — —	— — —	—	—
J. W. Maher, . . .	Pettibone,	Lanesborough, . . .	200	—
W. J. Cross, . . .	Shaker Mill,	Becket,	400	—
Jas. H. O'Hara, . . .	Glen,	Leyden,	500	500
Chas. H. Robertson, . . .	Hibbard,	Leyden,	—	250
Charles C. Stearns, . . .	Warwick and Miller's,	Northfield,	200	—

Fingerling Trout Plants during Fall of 1906—Continued.

[illegible]

Fingerling Trout Plants during Fall of 1906—Concluded.

APPLICANT.	Name of Brook.	Town.	Brook Trout.	Rainbow Trout.
Harry S. Tripp, .	Prior,	Spencer,	250	—
P. S. Callahan, .	Cannon,	Sturbridge,	250	—
Alex T. Brown, .	Caswell,	Sutton,	500	—
F. L. Hager, . .	North,	Winchendon,	250	—
F. J. Day, . . .	Bourn, Hadley Company,	Templeton,	250	—
Leroy F. Earle, .	Cold Meadow,	Templeton,	250	—
J. F. Despeaux, .	—	—	—	—
Henry W. Rogers, .	Mill,	West Upton,	250	—
Patrick Shaughnessy,	Bernard's,	South Upton,	250	—
C. A. Barker, . .	Bradish,	Upton,	250	—
Edward E. Whiting, .	Mill,	West Upton,	250	—
Joseph P. Kelley, .	Cold Spring,	Uxbridge,	500	—
W. H. Lewis, . .	Inman,	Uxbridge,	250	—
S. A. Ellsworth, .	Broad Meadow,	Worcester,	500	—
William Wadsworth, .	Holden,	Holden,	500	—
C. L. Allen, . . .	Barber,	Worcester,	500	—
C. N. Hargraves, .	Rattlesnake,	Frankingham,	500	—
S. J. Bigelow, . .	Swain's,	North Chelmsford,	200	—
F. J. Piper, . . .	Woods and Bixby,	Townsend,	750	—
Jeremiah Fitzgerald,	Ward's,	Andover,	500	—
Chas. H. Preston, .	Elliott,	Topsfield,	500	—
Fergus A. Butler, .	Fish,	Boxford,	500	—
John L. Russell, .	Dow's,	Ipswich,	250	—
C. E. Goodhue, . .	Bull,	Ipswich,	250	—
F. W. Marland, . .	Chandler,	West Andover,	250	—
W. H. Wickens, . .	Hardy's,	West Andover,	250	—
James D. Berry, . .	Frye Village,	Andover,	250	—
C. H. LeGrand, . .	Foster,	Methuen,	250	—
E. N. Atherton, . .	Foster,	Methuen,	250	—
Warren H. Beede, .	Law,	Lynnfield,	500	—
W. F. Finucane, . .	Barker's,	Methuen,	250	—
Harry B. Call, . .	Cold Spring,	Lawrence,	250	—
Frank J. Young, . .	Cold Spring,	Lawrence,	250	—
Fred G. Bushold, . .	Town Farm,	Methuen,	250	—
Claude H. Tarbox, .	Wheeler's,	Byfield,	500	—
Adelbert D. Thayer, .	Uncas, Woodward, Lone Star,	Franklin,	500	—
A. D. Wheeler, . .	Pine Tree,	Milton,	500	—
Clyde C. Hunt, . .	Black Fly,	Medway,	200	—
E. L. Freeman, . .	Nealous,	Franklin,	200	—
P. M. Woodman, . .	Potash,	West Medway,	200	—
William F. Barrett, .	Long,	Randolph,	200	—
John Haney, . . .	Mill,	Randolph,	200	—
P. J. Cahill, . . .	Stony,	Randolph,	200	—
M. E. Leahy, . . .	Long and Stony,	Randolph,	200	—
G. I. Simpson, . .	Fuller,	Attleborough,	200	—
Chas. H. Smith, . .	Fuller,	South Attleborough,	200	—
W. H. Butterfield, .	Shingle Island River,	Dartmouth,	500	—
Fred. Chadderton, .	Meadow,	Mansfield,	200	—
Ernest L. White, . .	Lowland,	Mansfield,	200	—
D. S. Spaulding, . .	Canoe River,	Mansfield,	200	—
Fred H. Miller, . .	—	—	—	—
Allen P. Hoard, . .	—	—	—	—
E. H. Waldron, . .	Cedar Swamp,	Lakeville,	200	—
George L. Peabody, .	Silver and Plyer,	Hanover,	500	—
John H. Frost, . .	Gray's,	Hyannis,	350	—
Chas. S. Baker, . .	Coonamissett,	Falmouth,	500	—
A. D. Norcross, . .	Conant,	Monson,	500 ¹	—
			38,950	2,000

¹ This lot was composed of 500 yearling brook trout.

PONDS STOCKED AND CLOSED IN ACCORDANCE WITH CHAPTER 91, SECTION 19, REVISED LAWS, AS AMENDED BY CHAPTER 274, ACTS OF 1903.

NAME OF POND.	Town.	Rainbow Fingerlings.	Rainbow Adults.	Brown Fingerlings.	Brown Adults.	Salmon Fingerlings.	Salmon Adults.	Brook Adults.	Landlocked Smelt Eggs.
Crane,	West Stockbridge, .	-	-	500	-	-	-	-	-
Mud,	West Stockbridge, .	-	-	500	-	-	-	-	-
Keyes,	Westford,	-	-	500	-	-	-	-	-
Fort Meadow,	Marlborough,	-	-	500	-	-	-	-	-
Forge,	Westford,	-	-	500	-	-	-	-	-
Spectacle,	Littleton and Ayer, .	-	-	-	-	500	-	-	-
Lake Wachusett,	Princeton,	-	-	500	-	-	-	-	-
Nuttings,	Billerica,	-	-	500	-	-	-	-	-
Spectacle,	Sandwich,	-	-	-	-	500	-	-	-
Dennis,	Yarmouth,	250	-	-	-	250	-	-	-
Bloody,	Plymouth,	1,000	-	-	-	500	-	-	-
Fresh,	Orleans,	250	-	-	-	250	-	-	-
Tispaquin,	Middleborough,	500	-	-	-	-	-	-	-
Hampton,	Westfield,	-	-	500	-	-	-	-	-
Lake Congamond,	Southwick,	-	-	500	-	-	-	-	-
Benton,	Otis,	1,000	-	-	-	500	-	-	-
Pratt,	Upton,	-	-	500	-	-	-	-	-
Lake Attitash,	Amesbury,	-	-	500	-	-	-	-	-
Archer's,	Wrentham,	1,000	-	-	-	-	-	-	-
Lake Pearl,	Wrentham,	-	-	500	-	-	-	-	-
Moore's,	Warwick,	1,000	-	-	-	-	-	-	-
Hardwick,	Hardwick,	500	40	-	6	500	1	136	2,000,000
Pottapaug,	Dana,	-	-	500	-	-	-	-	-
Flax,	Lynn,	-	11	500	-	-	-	24	-
Little Alum,	Brimfield,	250	-	-	-	250	-	-	-
Lake Winthrop,	Holliston,	-	-	300	-	-	-	-	-
		5,750	51	7,300	6	3,250	1	160	2,000,000

PONDS RESTOCKED IN 1906.

NAME OF POND.	Town.	Brook Adults.	Brown Trout Adults.	Pike Perch Adults.	Landlocked Smelt Eggs.
Lake Naukeag,	Ashburnham,	-	-	-	2,000,000
Forest Lake,	Palmer,	-	-	-	2,000,000
Onota Lake,	Pittsfield,	-	-	-	2,000,000
Garfield Lake,	Monterey,	-	-	-	2,000,000
Massapoag Lake,	Sharon,	-	-	18	-
Baddacook,	Groton,	-	23	-	-
Quinsigamond Lake,	Worcester,	115	-	-	-
		115	23	18	8,000,000

[C.]

DISTRIBUTION OF PHEASANTS.

Pheasants were liberated in the covers in various sections of the State, as indicated in the following list, which also embraces the names of applicants for birds:—

APPLICANT.	Town.	Number.
Alfred Crocker, Jr.,	Barnstable,	6
John Kendrick,	South Orleans,	6
Seth Damon,	Weymouth,	6
Edward B. Nevin,	South Weymouth,	6
Charles S. Baker,	Falmouth,	6
L. C. Humphrey,	Rochester,	6
Warren H. Beede,	Lynn,	6
Tobias H. Burke,	Quincy,	6
Fred H. Hill,	Attleborough,	6
Ernest S. Mann,	Foxborough,	6
Adelbert Ames,	Lowell,	6
Thomas W. Clegg,	Lawrence,	6
James F. Page,	Amherst,	6
A. M. Lyman,	Montague,	6
James H. O'Hara,	Greenfield,	6
Joseph P. Love,	Webster,	6
William F. Finucane,	Lawrence,	6
W. W. Bradbury,	Lawrence,	6
D. M. Merrill,	Hanson,	6
W. H. Reynolds,	Braintree,	6
H. R. Simpson,	Gloucester,	6
Maurice F. Dunn,	Gloucester,	6
Clarence C. Puffer,	Brockton,	6
E. A. Buffam,	Dedham,	6
A. B. F. Kinney,	Worcester,	6
Charles B. Adams,	Webster,	6
Edward E. Whiting,	West Upton,	6
Walter F. Durgin,	Hopedale,	6
H. P. Andrews,	Hudson,	6
L. F. Herrick,	Worcester,	6
John W. Tyler,	Warren,	6
Theodore C. Bates,	North Brookfield,	6
Merrill A. Stebbins,	Palmer,	6
Henry G. Trumble,	Monson,	6
George L. Brown,	Littleton,	6
Total, . . . .	. . . .	210

[D.]

DISTRIBUTION OF BELGIAN HARES.

APPLICANT.	Town.	Number.
Smith Phinney,	South Acton,	10
Peter Carr,	Provincetown,	10
A. M. Lyman,	Montague,	10
L. S. Dickinson,	Amherst,	10
Theodore C. Bates,	North Brookfield,	6
A. D. Norcross,	Monson,	6
Charles B. Adams,	Webster,	6
Thomas F. Ahearn,	Northampton,	6
Edward J. Brannigan,	Ware,	6
S. F. Stockwell,	West Millbury,	6
Fred. M. Smith,	South Hadley Falls,	6
Patrick Shaughnessy,	Upton,	6
William J. Quindley,	Middleborough,	8
Tobias H. Burke,	Quincy,	8
Edward B. Nevin,	South Weymouth,	8
W. H. Reynolds,	Braintree,	8
Seth Damon,	Weymouth,	8
Frank Seiberlich,	Medfield,	8
Walter F. Durgin,	Hopedale,	8
Henry M. Knowles,	New Bedford,	8
Frank H. Spooner,	North Dartmouth,	8
Warren H. Beede,	Lynn,	8
Sanborn G. Tenney,	Williamstown,	7
Total, . . . . .	. . . . .	175

[E.]

ARRESTS AND CONVICTIONS.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Arthur Perry, .	New Bedford,	Taking shellfish in violation of § 114, c. 91, R. L.,	Convicted,	\$5 00	Appealed; filed in Superior Court.
Joseph Frazier, .	New Bedford,		Convicted,	50 00	Appealed; withdrew and paid.
Joseph Monius, .	New Bedford,		Convicted,	5 00	
Joseph Miller, .	New Bedford,		Convicted,	50 00	
Manuel Costa, .	New Bedford,		Convicted,	5 00	
Joseph Souza, .	New Bedford,		Convicted,	5 00	
Napolean Maynard,	New Bedford,		Convicted,	5 00	
Constance Jarden,	New Bedford,		Convicted,	5 00	
Joseph Shapoet,	New Bedford,		Convicted,	5 00	
Antone Fradis, .	New Bedford,		Convicted,	5 00	
John Tressia, .	New Bedford,		Convicted,	5 00	
Michael St. George,	New Bedford,		Convicted,	5 00	
Joseph Herbert,	New Bedford,		Convicted,	5 00	
Manuel Martin, .	New Bedford,		Convicted,	5 00	
Jose Souza, .	New Bedford,		Convicted,	5 00	
Joseph Francis, .	New Bedford,		Convicted,	5 00	
Walter Lucklock,	New Bedford,		Convicted,	5 00	
Joseph Bestache,	New Bedford,		Convicted,	10 00	
Thomas Sawyer,	New Bedford,		Convicted,	10 00	
Alfred K. Aiken,	New Bedford,		Convicted,	5 00	
Antone Muroy, .	New Bedford,		Convicted,	5 00	
Manuel Cesmus,	New Bedford,		Convicted,	5 00	
Charles Graftier,	New Bedford,		Convicted,	5 00	
Phillias Goidoin,	New Bedford,		Convicted,	5 00	
Gaemieh Demura,	New Bedford,		Convicted,	5 00	
Charles Colechis,	New Bedford,		Convicted,	5 00	
Stanislais Saugelas,	New Bedford,		Convicted,	5 00	
Frank G. Furtado,	New Bedford,		Convicted,	5 00	
					Failed to pay; went to jail.

Manuel Oliver, . . .	New Bedford, . . .	Convicted, . . .	5 00	Filed.
Arthur Morgan, . . .	New Bedford, . . .	Convicted, . . .	—	Filed.
Frank J. Perron, . . .	New Bedford, . . .	Convicted, . . .	—	Filed.
Louis Hammer, . . .	New Bedford, . . .	Convicted, . . .	5 00	
Joseph Hammer, . . .	New Bedford, . . .	Convicted, . . .	5 00	
Manuel Silva, . . .	New Bedford, . . .	Convicted, . . .	—	Filed.
Philcas Briten, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Thomas Souza, . . .	New Bedford, . . .	Convicted, . . .	5 00	
Chris Knutcher, . . .	New Bedford, . . .	Convicted, . . .	5 00	
Golden Ballergen, . . .	New Bedford, . . .	Convicted, . . .	5 00	Appealed; still in Superior Court.
Lucas Breaualt, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Patrick Gordon, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Michael Flattery, . . .	New Bedford, . . .	Convicted, . . .	10 00	Failed to pay; house of correction.
Edwin McDermott, . . .	New Bedford, . . .	Convicted, . . .	10 00	Failed to pay; house of correction.
John W. Ferreria, . . .	New Bedford, . . .	Convicted, . . .	—	Minor; not prossed.
John Carlos, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Napoleon DeRossie, . . .	Fall River, . . .	Convicted, . . .	10 00	
Victor DeRossie, . . .	New Bedford, . . .	Convicted, . . .	10 00	
James Heys, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Arthur Miller, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Horace Francis, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Frank Sisson, . . .	New Bedford, . . .	Convicted, . . .	10 00	
Henry Dodd, . . .	Freetown, . . .	Convicted, . . .	—	
Henry Jackson, . . .	Fall River, . . .	Discharged, . . .	10 00	
		Discharged, . . .	—	Dogs got on rabbit trail by accident.
Eugene Brillman, . . .	Pittsfield, . . .	Convicted, . . .	—	Filed.
Chas. St. John, Jr., . . .	Pittsfield, . . .	Convicted, . . .	—	Filed.
William Boutell, . . .	East Lee, . . .	Convicted, . . .	15 00	
Peter Sires, . . .	East Lee, . . .	Convicted, . . .	15 00	
Amos Boutell, . . .	Lenoxdale, . . .	Convicted, . . .	15 00	
Henry Tower, . . .	Adams, . . .	Discharged, . . .	—	
— Mongel, . . .	—	—	—	
John Lebeau, . . .	Windsor, . . .	—	—	Left State before warrant served.
Harry Boigny, . . .	Natick, . . .	—	—	Left State before warrant served.
Joseph Mintongie, . . .	Agawam, . . .	Convicted, . . .	10 00	
John Angelini, . . .	Agawam, . . .	Convicted, . . .	10 00	
Antonio Marcouch, . . .	Wilbraham, . . .	Convicted, . . .	10 00	
Theodore Ferris, . . .	Southbridge, . . .	Convicted, . . .	10 00	
Edmond Wright, . . .	Abington, . . .	Convicted, . . .	10 00	
Frank Julian, . . .	Southbridge, . . .	Convicted, . . .	10 00	
Dennis Teriney, . . .	Southbridge, . . .	Convicted, . . .	10 00	
Nathan B. Foster, . . .	Rockland, . . .	Convicted, . . .	10 00	
Edward W. Dodge, . . .	Medford, . . .	Convicted, . . .	—	Filed.
John W. Marks, . . .	Lowell, . . .	Convicted, . . .	10 00	
George Melnick, . . .	South Deerfield, . . .	Convicted, . . .	—	Also hunting without license.

Taking shellfish in violation of § 114,
c. 91, R. L., . . .

Hunting on Lord's Day in violation of
c. 176, Acts of 1904, . . .

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Stefano Darbino,	Pittsfield,	Hunting on Lord's Day in violation of c. 176, Acts of 1904,	Convicted,	\$3 80	Filed at request of deputy.
William Johnson,	Brockton,		Convicted,	10 00	
Carl Johnson,	Brockton,		Convicted,	10 00	
Oscar Benson,	Brockton,		Convicted,	10 00	
James Griffin,	Auburn,		Convicted,	10 00	
James Dickeson,	Auburn,		Convicted,	10 00	
Phillip V. R. Ellis,	Brookline,		Convicted,	10 00	
John H. Ellis,	Brookline,		Convicted,	10 00	
Michael Potezza,	Boston,		Convicted,	10 00	
Israel Manchester,	Rowley,		Convicted,	—	
Ernest Louison,	West Stockbridge,		Convicted,	15 00	Filed.
Henry Laprade,	Auburn,		Convicted,	10 00	
Forest Hall,	Medfield,		Convicted,	10 00	
James Donnelly,	West Billerica,		Convicted,	—	
Arthur Smith,	Lowell,		Convicted,	—	
Patrick Pyne,	Lowell,		Convicted,	—	Filed.
Joseph Gibbs,	Middleborough,		Convicted,	10 00	
Ernest Gibbs,	Middleborough,		Convicted,	10 00	
James F. Holbrook,	Braintree,		Discharged,	—	Defaulted.
William H. Drollett,	Boston,		Discharged,	—	
Harry C. Wilber,	Braintree,		Discharged,	—	
Thomas Kiley,	Braintree,		Discharged,	—	
Frank C. Wentworth,	Braintree,		Discharged,	—	
George R. Edwards,	Stonham,	Hunting on Lord's Day in violation of c. 176, Acts of 1904,	Discharged,	—	Defaulted.
William Poole,	Randolph,		Discharged,	—	
Samuel Taylor,	Westford,		Discharged,	—	
W. E. Scoville,	Hartford (Ct.),		Convicted,	10 00	
John Brown,	Westfield,		—	—	
Leroy Clarke,	Medfield,		Convicted,	10 00	
Lowell D. Hoyt,	Chelsea,		Convicted,	10 00	
John Firefes,	Brimfield,		Convicted,	5 00	Filed.
George Castor,	Brimfield,		Convicted,	5 00	
Tony Tottalo,	Easton,		Convicted,	10 00	
Charles Lyons,	Easton,		Convicted,	10 00	Filed.
Jesse Gibbs,	Easton,		Convicted,	10 00	
Robert Smilie,	New Bedford,		Convicted,	10 00	
Lawrence Smilie,	New Bedford,		Convicted,	10 00	
William E. Ball,	New Bedford,		Convicted,	10 00	
John Moloney,	Brighton,		Convicted,	10 00	

Alfred O'Brien,	Brighton,	Convicted,	10 00	
Fred W. Smith,	Brighton,	Convicted,	10 00	
Joseph Carey,	Boston,	Convicted,	15 00	
Fred Hart,	Lynn,	Convicted,	15 00	
Eugene McKenzie,	East Bridgewater,	Convicted,	3 00	
Ray Lowery,	East Bridgewater,	Convicted,	3 00	
Harry Hobart,	Hanson,	Discharged,	—	Filed.
Harry Sampson,	Hanson,	Convicted,	—	Defendant did not appear.
George Galante,	Maynard,	—	—	
Allen Butler,	Lenox,	Convicted,	10 00	
Eugene Genior,	Somerville,	—	—	
Ferdinand Caruti,	Somerville,	—	—	Reported to probation officer as boys, and were discharged.
Edgar O. Pratt,	Pembroke,	Convicted,	15 00	
Lambertus Kroon,	South Boston,	Convicted,	10 00	
Bernardus Schutte,	South Boston,	Convicted,	10 00	
Roelof Taatjes,	South Boston,	Convicted,	10 00	
Giuseppe Abbiati,	Holliston,	Convicted,	10 00	
Worthy Kennedy,	Hardwick,	Discharged,	—	Shooting at target.
Luigi Bogino,	Washington,	Convicted,	10 00	Paid also costs of \$1.20.
Herman Shumway,	South Hadley,	Convicted,	10 00	Failed to pay; jail for 20 days.
Peter Robertson,	Chicopee Falls,	Convicted,	10 00	
Anatolie Chevalier,	Chicopee Falls,	Convicted,	10 00	
Martine Huttie,	North Adams,	Convicted,	10 00	
Martin Rochford,	Springfield,	Convicted,	10 00	
Tony Champi,	Methuen,	Convicted,	10 00	
Carlo Champi,	Methuen,	Convicted,	10 00	
Edwin F. Parsons,	East Gloucester,	Convicted,	20 00	
John W. Savage,	Charlestown,	Convicted,	17 00	
Manuel Viator,	Gloucester,	Convicted,	15 00	
John Viator,	Gloucester,	Convicted,	15 00	
Allen R. Gorham,	Kingston,	Convicted,	15 00	
Joseph P. Hayes,	Gloucester,	Convicted,	14 00	
J. W. DeCoste,	Gloucester,	Convicted,	12 50	Fined \$7 on revision.
Wm. B. Pritchard,	Winthrop,	Convicted,	26 00	
Charles Neil,	Beachmont,	Convicted,	56 00	
William Lecraw,	Marblehead,	Convicted,	11 00	
John Colfer,	Salem,	Convicted,	12 00	
Susan E. Richardson,	Plymouth,	Convicted,	5 00	
Elijah A. Keith,	Brockton,	Convicted,	21 00	
Frank E. Wordsworth,	South Duxbury,	Convicted,	24 00	
Preston A. Wright,	Bourne,	Convicted,	50 00	
Shadrack F. Swift,	Bourne,	Convicted,	50 00	
Albert Nighingale,	Plymouth,	Convicted,	50 00	
Frank A. Gove,	Nahant,	Convicted,	12 00	

Hunting on Lord's Day in violation of
c. 170, Acts of 1904,

Having short lobsters in violation of § 88,
c. 91, R. L.,

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE <i>v.</i> —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Walter F. Kelley,	Hull,	Having short lobsters in violation of § 88, c. 91, R. L.,	Convicted,	\$36 00	Reduced to \$47.20 on revision. Filed on revision.
Joseph S. Moniz,	Gloucester,		Convicted,	59 00	
Joseph S. Moniz,	Gloucester,		Convicted,	2 75	
Samuel Lucas,	Lanesville,		Convicted,	6 50	-
Frank James,	Hull,		Convicted,	10 00	
John Lindberg,	Point Shirley,		Convicted,	12 00	
E. C. Hadley,	Point Shirley,		Discharged,	-	-
Nicholas Jacomos,	New Bedford,		Discharged,	-	
Michael J. Skayhan,	New Bedford,		Convicted,	10 00	
L. Melvin Johnson,	Boston,		Convicted,	1 00	-
Joseph A. Bowman,	Boston,		Convicted,	2 00	
Edward J. Smith,	Charlestown,		Convicted,	5 00	
Frederick B. Washburn,	Charlestown,		Convicted,	5 00	-
Walter H. Berry,	Quincy,		Discharged,	-	
John E. Keenan,	Quincy,		Discharged,	-	
Perry J. Wortman,	Taunton,	Hunting without license in violation of c. 317, Acts of 1905,	Convicted,	10 00	-
S. F. Kelley,	Boston,		Convicted,	5 00	
Philip Cufire,	Brockton,		Convicted,	6 00	
Mike Albino,	Springfield,		Convicted,	10 00	Claimed he was going home with borrowed gun.
Michael Rivvetti,	Springfield,		Discharged,	-	
Vincento Simone,	Springfield,		Convicted,	10 00	
Philip Patti,	Springfield,		Convicted,	10 00	Failed to pay; jail for 20 days.
Louis Ocorinci,	New York, N. Y.,		Convicted,	25 00	
Domenico Frati,	Cheshire,		Convicted,	10 00	
George Melnick,	South Deerfield,	Hunting without license in violation of c. 317, Acts of 1905,	Convicted,	3 00	See also Sunday hunting. Filed; see Sunday hunting.
Stefano Darbenio,	Pittsfield,		Convicted,	-	
John Ravelle,	New York, N. Y.,		Convicted,	25 00	
Frank Jurleo,	Warren,		Convicted,	5 00	-
Toney Jarusso,	Warren,		Convicted,	5 00	
Angelo Pitterutti,	Warren,		Convicted,	5 00	
Ernest Louison,	West Stockbridge,		Convicted,	-	Filed. Not prossed. Not prossed.
Aniolo Siano,	Springfield,		-	-	
Luigi Albano,	Springfield,		-	-	
Mike Demietra,	Warren,	-	Convicted,	5 00	Filed.
Dominion Mitiano,	Easton,		Convicted,	-	
Hugh Campbell,	Easton,		Convicted,	2 00	
Jacob Daniels,	Maynard,	-	Convicted,	-	Filed on promise to secure license, which he did.

Jeremiah Connor,	Taunton,	Convicted,	-	Filed.
Negub Sabor,	Fall River,	Convicted,	15 00	
Lambertus Kroon,	South Boston,	Convicted,	10 00	
Bernardus Schutte,	South Boston,	Convicted,	10 00	
Roeloff Taates,	South Boston,	Convicted,	10 00	
Guiseppe Abbiatti,	Holliston,	Convicted,	10 00	
Arthur Beauchard,	Holyoke,	Convicted,	10 00	
Luigi Bogino,	Washington,	Convicted,	10 00	Filed on payment of costs.
John A. Tatesosian,	Grafton,	Convicted,	-	
Edward Thomas,	Springfield,	Convicted,	10 00	
Andrew Rhodes,	Williamstown,	Discharged,	-	
Dyer Utman,	Williamstown,	Discharged,	-	
David Somerville,	Lenox,	Convicted,	20 00	Appealed; Superior Court, Jan-
Amos Boutell,	Lenoxdale,	Convicted,	10 00	uary, 1907.
J. Clinton Bradway,	Monson,	Discharged,	-	
William Dumond,	North Adams,	Convicted,	2 00	
Fred Lemire,	Baldwinsville,	Convicted,	10 00	
Israel Manchester,	Rowley,	Convicted,	10 00	
Oscar Benson,	Bridgewater,	Convicted,	-	See Sunday hunting.
Allen Butler,	Lenox,	Convicted,	5 00	
Jeremiah Connor,	Taunton,	Convicted,	10 00	
James D. Purcell,	Taunton,	Convicted,	20 00	
Albert L. Stratton,	Gardner,	Convicted,	40 00	
Antone Huttie,	North Adams,	Convicted,	-	Filed; see Sunday hunting.
Albert Lederer,	Holyoke,	Convicted,	10 00	
George Melnick,	South Deerfield,	Convicted,	-	See Sunday hunting, also hunting
Thomas Modena,	Montgomery,	Convicted,	10 00	without license.
Frank Jurico,	Warren,	Convicted,	10 00	
Angelo Pitterutti,	Warren,	Convicted,	10 00	
Eugene Genior,	Somerville,	Convicted,	-	See Sunday hunting.
Ferdinand Caruti,	Somerville,	Convicted,	-	See Sunday hunting.
Toney Basso,	Methuen,	Convicted,	10 00	
Bennie Kaplan,	Methuen,	Convicted,	10 00	
Liberato Grosse,	Methuen,	Convicted,	10 00	
James Spera,	Methuen,	Convicted,	10 00	
Egge Grosse,	Methuen,	Convicted,	10 00	
Five Wanzi,	Methuen,	Convicted,	10 00	
Andrew Cibella,	Methuen,	Convicted,	10 00	
Michael Wanzi,	Methuen,	Convicted,	10 00	
Gadeno Gracco,	Methuen,	Convicted,	10 00	
James Ricciardison,	North Woburn,	Convicted,	-	Filed.
William Wallace,	Westfield,	Convicted,	-	Filed.
William Martin,	Westfield,	Convicted,	10 00	

Hunting without license in violation of c. 317, Acts of 1905, .

Allowing dogs to chase deer in violation of c. 245, Acts of 1905, .

Illegal possession of game, .

Killing song or insectivorous birds in violation of c. 287, Acts of 1903, .

Having short trout in violation of § 64, c. 91, R. L., as amended by c. 190, Acts of 1905, .

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Tony Klein.	Westfield.	Having short trout in violation of § 64, as amended by c. 190, Acts of 1905, c. 91, R. L.,	Convicted.	\$10 00	Filed.
Charles Brown.	Springfield.		Convicted.	10 00	
A. H. Jackson.	West Springfield.		Convicted.	10 00	
John Curran.	Westfield.		Convicted.	—	
Delour Foulin.	Westfield.		Convicted.	10 00	
Fred H. Hawkins.	Westfield.	Fitchburg.	Convicted.	10 00	Notice not served on present corporation.
Louis Jones.	Greenfield.		Convicted.	10 00	
Fred Smith.	Fitchburg.		Convicted.	10 00	
Theodore Butts.	Brooklyn, N. Y.,		Convicted.	20 00	
George C. More.	Westford.		Discharged.	—	
E. E. Eames.	Paxton.	Sawdust pollution in violation of § 8, c. 91, R. L.,	Convicted.	25 00	Filed.
Everett E. Tarbell.	Pepperell.		Convicted.	6 00	
Andrew Kemp.	Pepperell.		Convicted.	5 00	
Theodore A. Leonard.	Raynham.		Convicted.	20 00	
Thomas McAuliff.	Lynn.		Convicted.	—	
John W. Hill.	Lynn.	Fishing closed ponds in violation of § 19, c. 91, R. L., as amended by c. 274, Acts of 1903,	Convicted.	—	Filed.
Harold A. Sablin.	Lynn.		Convicted.	—	
Joseph Mousette.	Lynn.		Convicted.	1 00	
B. F. Dunn.	Dunstable.		Convicted.	20 00	
Richard Hoepecke.	Monterey.		Convicted.	5 00	
Max Bunke.	Monterey.	Ware.	Convicted.	5 00	Filed.
Louis F. Walking.	Boston.		Convicted.	10 00	
Sanford F. Petts.	Boston.		Convicted.	10 00	
Dennis Lafire.	Boston.		Convicted.	10 00	
Charles Barnum.	Indian Orchard.		Convicted.	5 00	
Alfred Shaw.	Indian Orchard.	Having short pickerel in violation of § 67, c. 91, R. L.,	Convicted.	5 00	Filed; paid costs \$10.
John E. May.	Magnolia.		Convicted.	5 00	
Raymond Simonds.	Magnolia.		Convicted.	3 00	
Eugene E. Dennison.	Millbury.		Convicted.	4 00	
Samuel Goldstein & Son.	Boston.		Convicted.	—	
H. S. Leven.	Boston.	Having pike perch in violation of c. 179, Acts of 1906,	—	—	Confiscated; sold for \$10.
W. S. Leven.	Boston.		—	—	
Abraham Isenberg.	Boston.		—	—	
Philip Prevoy.	Boston.		—	—	
Manusia Krantzman.	Boston.		—	—	
Herbert Trickey.	West Warren.	Trout out of season in violation of § 62, c. 91, R. L., Setting fish trap without permit, § 118, c. 91, R. L.,	—	—	Confiscated; sold for \$10.
Zoeth A. Sherman.	Yarmouth.		Convicted.	10 00	
			Convicted.	10 00	Confiscated; sold for \$5.

A. Y. Bousquet,	Fitchburg,	Having smelts in close season in violation of § 71, c. 91, R. L.,	Discharged,	—	
Frank Vololsky,	Maynard,		Convicted,	30 00	
Harry Morales,	Weymouth,		Convicted,	—	
Chester B. Peterson,	Whitman,		Discharged,	—	
Michael Rivivethi,	Littleton,	Having pheasants in close season in violation of c. 482, Acts of 1906,	Discharged,	20 00	
Henry S. Searls,	Whitinsville,		Convicted,	—	
George Nurse,	Gloucester,		Convicted,	100 00	
George Bragg,	Gloucester,		Convicted,	100 00	
Joseph Parrot,	Ludlow,		Convicted,	100 00	
Clyde Ross,	Groton,	Killing deer in violation of § 17, c. 91, R. L., as amended by c. 419, Acts of 1905,	—	—	Committed to jail. Filed without finding, to avoid criminal record.
Edward Perrin,	Groton,		—	—	Filed without finding, to avoid criminal record.
Edward S. Talbot,	Sandwich,		Convicted,	100 00	
Edward Gearin,	Brookfield,		Convicted,	20 00	
Philip Boynton,	Brookfield,		Convicted,	20 00	
William H. Pratt,	Whitman,	Using more than ten hooks in violation of § 26, c. 91, R. L.,	Convicted,	20 00	
Edwin Hoyle,	West Millbury,		Convicted,	—	Filed; paid costs of \$5.
John E. Dunkerly,	West Millbury,		Discharged,	—	Filed; paid costs of \$5.
Howard Hastings,	West Springfield,		Convicted,	20 00	Definition of trawl not satisfactory.
Bernardo Zanolie,	Montgomery,		Convicted,	20 00	
Fortunata Zanolie,	Montgomery,		Convicted,	20 00	
Tony Tomarini,	Montgomery,		Convicted,	20 00	
Joseph Irish,	Westfield,	Snaring game in violation of § 11, c. 92, R. L., as amended by c. 241, Acts of 1906,	Convicted,	20 00	
George Sandusky,	Westfield,		Convicted,	20 00	Appealed; continued to May, 1907, term of Superior Court.
Amieo Siano,	Springfield,		Convicted,	20 00	
Luigi Albano,	Springfield,		Convicted,	20 00	
Aubury McLane,	Sutton,	Having short bass in violation of § 70, c. 91, R. L.,	Discharged,	—	
Howard Hastings,	West Springfield,		Convicted,	—	Filed; see under short pickerel.
Eugene E. Dennison,	Millbury,		Convicted,	—	
Harry Lamb,	Southwick,	Buying partridges in violation of § 2, c. 92, R. L., as amended by c. 206, Acts of 1903,	Convicted,	20 00	
George F. Gehle,	Westfield,	Selling partridges in violation of § 2, c. 92, R. L., as amended by c. 206, Acts of 1903,	Convicted,	20 00	
Joseph Irish,	Westfield,		Convicted,	—	Filed.
Walter K. Hadselle,	Hancock,	Setting snares in violation of § 11, c. 92, R. L., as amended by c. 241, Acts of 1906,	Convicted,	100 00	
Amieo Albano,	Springfield,		Discharged,	—	
Luigi Albano,	Springfield,		Discharged,	—	
Frank O. Downing,	Saugus,		Convicted,	20 00	
F. B. Washburn,	Quincy,	Selling scallops in close season in violation of § 83, c. 91, R. L.,	Convicted,	20 00	
Oscar Kallinski,	Winchendon,	Trapping fish in violation of § 132, c. 91, R. L.,	Discharged,	—	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Concluded.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Orin H. Eldredge, Samuel D. Eldredge,	South Chatham, South Chatham,	{ Taking scallops less than 2 inches in diameter, in violation of § 84, c. 91, R. L., as amended by c. 288, Acts of 1906, Taking game from State in violation of § 21, c. 92, R. L., Illegal possession of feathers of certain birds for millinery purposes, c. 329, Acts of 1903, Killing and possession of heron in violation of c. 244, Acts of 1903, Hunting with ferret in violation of § 11, c. 91, R. L., as amended by c. 241, Acts of 1906, }	Convicted,	\$20 00	
			Convicted,	20 00	
John Matesoasi,	New York, N. Y.,		Convicted,	10 00	
Latimer W. Ballou,	Woonsocket, R. I.,		Convicted,	10 00	
Napoleon Larosque,	Chicopee,		Convicted,	—	Filed.
William J. Dana,	Taunton,		Convicted,	—	Filed.
Joseph Parrott,	Ludlow,		Convicted,	10 00	
Thomas E. Riel,	Barre Plains,		Convicted,	5 00	
Archie Mattison,	Blackinton,		Convicted,	20 00	Ferret confiscated and killed.
Fred Moran,	Millbury,		Convicted,	—	Filed; first offence.
Harvey Peters,	Lenox,	{	Convicted,	—	Filed; killed ferret.
Harry Bakewell,	Lynn,		Convicted,	20 00	
Arthur Pettit,	Millbury,		Convicted,	20 00	
James Donnelly,	West Billerica,		Convicted,	20 00	
Arthur Smith,	Lowell,		Convicted,	20 00	
Patrick Pyne,	Lowell,		Convicted,	20 00	
Henry Petit,	Millbury,		Convicted,	—	Filed.

[F.]

LEGISLATION.

Acts of 1906.

[CHAPTER 141.]

AN ACT TO PREVENT THE EXTERMINATION OF THE HEATH HEN, SO-CALLED.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful to hunt, take or kill that species of pinnated grouse commonly called heath hen, and scientifically known as *Tympanuchus cupido*, or to buy, sell, otherwise dispose of, or have in possession the same or any part thereof, previous to the first day of November in the year nineteen hundred and eleven.

SECTION 2. So much of section four of chapter ninety-two of the Revised Laws as is inconsistent herewith is hereby repealed.

SECTION 3. Whoever violates any provision of this act shall be punished by a fine of one hundred dollars for each bird or part thereof in respect to which such violation occurs.

SECTION 4. This act shall take effect five days after its passage.
[Approved March 7, 1906.]

[CHAPTER 179.]

AN ACT RELATIVE TO THE TRANSPORTATION AND SALE OF PIKE-PERCH.

Be it enacted, etc., as follows:

SECTION 1. No person shall kill within this Commonwealth, between the first day of February and the first day of June in any year, any fish known as pike-perch; and no company, firm or person shall transport into or within this Commonwealth any of the said fish caught between the said dates, wherever the same were caught.

SECTION 2. The commissioners on fisheries and game and their deputies are hereby authorized to seize and confiscate fish killed or transported in violation of the preceding section, and it shall be the duty of every officer designated in section four of chapter ninety-one of the Revised Laws to seize fish so killed or transported, and to report the seizure to the said commissioners, who shall authorize the sale of such fish; and the proceeds of any such sale, after paying the expenses of the sale, shall be paid into the treasury of the Commonwealth.

SECTION 3. Any company, firm or person violating the provisions of this act shall be liable to a penalty of fifty dollars, and of ten dollars additional for each fish killed or transported in violation of the provisions of this act.

SECTION 4. This act shall take effect upon its passage. [*Approved March 20, 1906.*]

[CHAPTER 239.]

AN ACT RELATIVE TO THE TAKING OF SHINERS FOR BAIT.

Be it enacted, etc., as follows:

SECTION 1. It shall be lawful to take shiners for bait in any of the waters of the Commonwealth by means of a circular or hoop net not exceeding six feet in diameter, or by means of a rectangular net other than a seine, containing not more than thirty-six square feet of net surface.

SECTION 2. The provisions of section twenty-six of chapter ninety-one of the Revised Laws, as amended by chapter three hundred and eight of the acts of the year nineteen hundred and four, and of section one hundred and thirty-two of said chapter ninety-one, shall not apply to a person taking fish other than shiners by means of the apparatus described in section one: *provided*, that such other fish are immediately returned alive to the water.

SECTION 3. This act shall take effect upon its passage. [*Approved April 5, 1906.*]

[CHAPTER 241.]

AN ACT TO PROVIDE FOR THE CONFISCATION OF FERRETS IN CERTAIN CASES.

Be it enacted, etc., as follows:

Section eleven of chapter ninety-two of the Revised Laws is hereby amended by adding at the end thereof the words:—Ferrets which are used in violation of the provisions of this section shall be confiscated,—so as to read as follows:—*Section 11.* Whoever takes or kills a game bird or water fowl, hare or rabbit by means of a trap, net or snare, or by the use of a ferret; and whoever, for the purpose of taking or killing a game bird, water fowl, hare or rabbit, constructs or sets a trap, snare or net or uses a ferret; and whoever shoots at or kills any wild fowl or any of the so-called shore, marsh or beach birds with a swivel or pivot gun or by the use of a torch, jack or artificial light, or pursues any wild fowl with or by aid of a boat propelled by steam or naphtha, or of a boat or vessel propelled by any mechanical means other than sails, oars or paddles, or in that portion of Boston harbor lying westerly and southwesterly of a line running from Deer Island to Point Allerton, including the waters of Dorchester bay, Quincy bay, Weymouth bay and Hingham bay, shoots at, kills or pursues a wild fowl from or by the aid or use of any boat or floating device propelled by steam, naph-

tha, gasoline, electricity, compressed air, or any similar motive power, shall be punished by a fine of twenty dollars for each offence. The constructing or setting of a trap, snare or net adapted for the taking or killing of a game bird, water fowl, hare or rabbit, upon premises frequented by them, shall be prima facie evidence of such constructing and setting with intent to take and kill contrary to law; and possession of a ferret in a place where the game mentioned in this section might be taken or killed, shall be prima facie evidence that the person having it in possession has used it for taking and killing game contrary to law. Ferrets which are used in violation of the provisions of this section shall be confiscated. [*Approved April 5, 1906.*]

[CHAPTER 263.]

AN ACT TO PROHIBIT THE SALE OF TROUT, EXCEPT THOSE ARTIFICIALLY REARED.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful at any time within three years after April eighth, nineteen hundred and six, to buy or sell trout, or to offer trout for sale, within the Commonwealth: *provided, however*, that nothing in this act shall prevent the sale of trout artificially propagated or maintained or hatched from the egg in the house of the owner and grown in pools of said owner, in so far as the sale thereof is permitted by the laws of this Commonwealth now in force.

SECTION 2. Whoever violates any provisions of this act shall be punished by a fine of one dollar for each trout so bought, sold or offered for sale.

SECTION 3. This act shall take effect on the eighth day of April in the year nineteen hundred and six. [*Approved April 9, 1906.*]

[CHAPTER 274.]

AN ACT RELATIVE TO THE PROTECTION OF WOOD OR SUMMER DUCK.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful, prior to the first day of September in the year nineteen hundred and eleven, to hunt, capture, wound or kill a wood or summer duck.

SECTION 2. Whoever violates the provisions of this act shall be punished by a fine of not more than fifty dollars for each violation. The possession of any wood duck or summer duck, or any part thereof, shall be prima facie evidence of a violation of the provisions of this act. [*Approved April 12, 1906.*]

[CHAPTER 278.]

AN ACT TO PROVIDE FOR THE BETTER PROTECTION OF RUFFED GROUSE.

Be it enacted, etc., as follows:

Section twelve of chapter ninety-two of the Revised Laws is hereby amended by striking out the words "or snaring of ruffed grouse, commonly called partridge, or", in the second and third lines, and inserting in place thereof the words:— other than by snare, of, — so as to read as follows:— *Section 12.* The provisions of the preceding section shall not apply to the trapping, other than by snare, of hares or rabbits upon his land by an owner of land, or by a member of his family if authorized by him, between the first day of October and the first day of December. [*Approved April 12, 1906.*]

[CHAPTER 288.]

AN ACT RELATIVE TO SCALLOPS.

Be it enacted, etc., as follows:

Section eighty-four of chapter ninety-one of the Revised Laws is hereby amended by striking out the word "seed", in the first line, and by inserting after the word "scallops", in the same line, the words:— less than two inches in diameter, said diameter being a straight line drawn from the outside edge of the scallop perpendicular to the middle point of the outside line of the hinge, — so as to read as follows:— *Section 84.* Whoever takes scallops less than two inches in diameter, said diameter being a straight line drawn from the outside edge of the scallop perpendicular to the middle point of the outside line of the hinge, from the flats or waters of the Commonwealth shall be punished by a fine of not less than twenty nor more than fifty dollars for each offence; but such penalty shall not be incurred by any person taking such scallops who returns them alive to the flats or waters from which they were taken. [*Approved April 14, 1906.*]

[CHAPTER 292.]

AN ACT TO PROHIBIT THE USE OF LIVE DUCK DECOYS IN THE TAKING OF KILLING OF BLACK DUCKS IN THE COUNTY OF NANTUCKET.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful to use live duck decoys for the taking or killing of black ducks in the county of Nantucket.

SECTION 2. Whoever violates any provision of this act shall be punished by a fine of not less than twenty nor more than fifty dollars for each offence. [*Approved April 16, 1906.*]

[CHAPTER 301.]

AN ACT RELATIVE TO DUCKS AND TEAL.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful to kill a black duck, scientifically known as *Anas obscura*, or a teal, between the first day of March and the first day of September following, or any species of wild duck, not otherwise protected by law, between the twentieth day of May and the first day of September, or to buy, sell or have in possession a black duck or teal, between the first day of March and the first day of September, or any of the wild duck species during the time within which the taking or killing thereof is prohibited, whenever or wherever such birds may have been taken or killed: *provided, however*, that any person, firm or corporation holding a permit from the commissioners on fisheries and game may buy, sell or have in possession, any species of duck for purposes of propagation; and *provided, further*, that a person, firm or corporation dealing in game or engaged in the cold storage business may have in possession for storage any species of duck between the first day of March and the first day of September following, if such birds were not taken or killed in this Commonwealth contrary to the provisions of this chapter, or were not taken, killed, or transported contrary to the law of the state or country in which such birds were taken or killed, and *provided*, that such persons, firms or corporations shall have notified in writing the commissioners on fisheries and game on or before March first of the species, number of each species, and place of storage of such birds, and that such birds are in places and packages convenient for sealing. The commissioners or their deputies shall then place a seal upon all receptacles and packages containing any species of wild duck. The said seal shall not be removed by any person other than the commissioners on fisheries and game, or their deputies, under a penalty of twenty dollars for each bird, and shall be removed by the said commissioners or their deputies upon the first day of September of each year. The packages or contents thereof so sealed shall not be removed from that storage warehouse under a penalty of twenty dollars for each bird.

SECTION 2. Section four of chapter ninety-two of the Revised Laws is hereby repealed.

SECTION 3. Whoever violates any provision of this act shall be punished by a fine of twenty dollars for each bird or part thereof, in respect to which the violation occurs.

SECTION 4. This act shall take effect on the first day of January in the year nineteen hundred and seven. [*Approved April 23, 1906.*]

[CHAPTER 303.]

AN ACT RELATIVE TO QUAIL.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful to take or kill a quail between the first day of December and the first day of November, or to have in possession for the purpose of sale, or to buy, sell, offer for sale or otherwise dispose of at any time a quail, or any part thereof, killed in this Commonwealth. But a person, firm or corporation dealing in game, or engaged in the cold storage business, may buy, sell, or have in possession, and a person may buy from such person, firm or corporation, and have in possession if so bought, quail from the first day of November to the first day of January following, if such quail or parts thereof were not taken in this Commonwealth, or were not taken, killed, bought, sold or otherwise disposed of or transported contrary to the laws of any state or country. And a person, firm or corporation dealing in game or engaged in the cold storage business may have quail in possession in cold storage for storage purposes, at any season, if such quail were not taken or killed in this Commonwealth, and were not taken, killed, bought, sold or otherwise procured or disposed of, or transported contrary to the laws of the state or country in which the quail were taken, killed or transported: *provided, however*, that such persons, firms or corporations shall have notified in writing the commissioners on fisheries and game on or before January first in each year of the species, number of each species, and place of storage of such birds, and that such birds are in places and packages convenient for sealing. The commissioners or their deputies shall then place a seal upon all receptacles and packages containing any species of quail. The said seal shall not be removed by any person other than the commissioners on fisheries and game, or their deputies, and shall be removed by the said commissioners or their deputies upon the first day of November of each year. The packages so sealed shall not be removed from that storage warehouse under a penalty of twenty dollars for each bird: *provided, however*, that any person, firm or corporation holding a permit from the commissioners on fisheries and game may buy, sell, or have in possession live quail for purposes of propagation within the Commonwealth, and for no other purpose.

SECTION 2. Section three of chapter ninety-two of the Revised Laws, as amended by chapter four hundred and six of the acts of the year nineteen hundred and five, is hereby repealed.

SECTION 3. Whoever violates any provision of this act shall be punished by a fine of twenty dollars for each bird or part thereof, in respect to which the violation occurs. The possession, except as provided above, of quail during the season when taking, killing, or sale is pro-

hibited by law shall be prima facie evidence that the person having possession has violated some provision of this act.

SECTION 4. This act shall take effect on the first day of January in the year nineteen hundred and seven. [*Approved April 23, 1906.*]

[CHAPTER 304.]

AN ACT TO PROHIBIT THE SALE OF PRAIRIE CHICKENS.

Be it enacted, etc., as follows:

SECTION 1. It shall be unlawful to buy, sell, or otherwise dispose of, or to have in possession, a prairie chicken, scientifically known as *Tympanuchus Americanus*, and as *Pediocetes phasianellus*, or any part thereof, whenever or wherever taken.

SECTION 2. Whoever violates any provision of this act shall be punished by a fine of twenty dollars for each bird or part thereof, in respect to which the violation occurs, and possession shall be prima facie evidence that the person having possession has violated the provisions of this act.

SECTION 3. This act shall take effect on the first day of January in the year nineteen hundred and seven. [*Approved April 23, 1906.*]

[CHAPTER 314.]

AN ACT RELATIVE TO THE TAKING AND SALE OF TROUT, LAND LOCKED SALMON AND LAKE TROUT.

Be it enacted, etc., as follows:

SECTION 1. Section sixty-two of chapter ninety-one of the Revised Laws is hereby amended by striking out the word "September", in the second line, and inserting in place thereof the word:— August,— by striking out the words "first day of April, or, in the counties of Berkshire, Franklin, Hampden and Hampshire between the first day of August and the first day of April", in the second, third and fourth lines, and inserting in place thereof the words:— fifteenth day of April,— so as to read as follows:— *Section 62.* Whoever takes a trout, land locked salmon or lake trout between the first day of August and the fifteenth day of April shall forfeit not less than ten nor more than twenty-five dollars for each offence. Whoever buys such fish taken between said dates in this Commonwealth or takes such fish with a net or salmon pot at any season of the year shall forfeit not less than five nor more than twenty dollars for each fish so taken.

SECTION 2. Section sixty-three of said chapter ninety-one, as amended by chapter one hundred and thirty-seven of the acts of the year nineteen

hundred and two, is hereby further amended by striking out the word "September", in the fifth line, and inserting in place thereof the word: — August, — by striking out the words "first day of April", in the same line, and inserting in place thereof the words: — fifteenth day of April, — and by striking out the words "or in the counties of Berkshire, Franklin, Hampden and Hampshire, between the fifteenth day of July and the fifteenth day of April", in the fifth, sixth, seventh and eighth lines, so as to read as follows: — *Section 63.* Whoever, except as provided in section sixty-six, sells or offers or exposes for sale, or has in his possession, a trout, land locked salmon or lake trout, except alive, between the first day of August and the fifteenth day of April, shall forfeit not less than ten nor more than twenty-five dollars for each offence; and the possession of any such fish between said dates shall be prima facie evidence to convict.

SECTION 3. Nothing herein contained shall be construed as affecting or repealing the provisions of chapter two hundred and five of the acts of the year nineteen hundred and three.

SECTION 4. This act shall take effect on the thirty-first day of March in the year nineteen hundred and seven. [*Approved April 24, 1906.*]

[CHAPTER 327.]

AN ACT TO PROVIDE FOR THE PROTECTION OF PROPERTY AND MATERIAL USED BY THE COMMISSIONERS ON FISHERIES AND GAME IN MAKING SCIENTIFIC INVESTIGATIONS.

Be it enacted, etc., as follows:

Whoever wilfully and without right enters in or upon any building or other structure or any area of land or water set apart and used by or under authority of the commissioners on fisheries and game for conducting scientific experiments or investigations after said commissioners have caused printed notices of such occupation and use and the purposes thereof to be placed in a conspicuous position adjacent to any such areas of land or water or upon any such building or other structure, and any person who wilfully and maliciously injures or defaces any such building or other structure or any notice posted as aforesaid, or injures or destroys any property used in such experiments or investigations, or otherwise interferes therewith, shall be punished by imprisonment for not more than six months or by a fine of not more than two hundred dollars. And said commissioners and their deputies are hereby authorized to arrest without warrant any person found violating the provisions of this act. [*Approved April 28, 1906.*]

[CHAPTER 356.]

AN ACT RELATIVE TO THE DISCHARGE OF SAWDUST INTO STREAMS.

Be it enacted, etc., as follows:

SECTION 1. Section eight of chapter ninety-one of the Revised Laws is hereby amended by striking out the word “shall”, in the fifth line, and inserting in place thereof the word: — may, — by inserting after the word “time”, in the ninth line, the following: — Before any such order is made said commissioners shall, after reasonable notice to all parties in interest, give a public hearing in the county where the sawmill to be affected by the order is located, at which hearing any citizen shall have a right to be heard on the questions to be determined by the commissioners. Upon petition of any party aggrieved by such order, filed within six months after the date thereof, the superior court, sitting in equity, may, after such notice as it shall deem sufficient, hear all interested parties and annul, alter or affirm said order, — and by inserting after the word “commissioners”, in the twelfth line, the words: — or of said court, if an appeal is taken, — so as to read as follows: — *Section 8.* If the commissioners determine that the fish of any brook or stream in this Commonwealth are of sufficient value to warrant the prohibition or regulation of the discharge therein of sawdust from sawmills, and that the discharge of sawdust from any particular sawmill materially injures such fish, they may, by an order in writing to the owner or tenant of such sawmill, prohibit or regulate the discharge of sawdust therefrom into such brook or stream. Such order may be revoked or modified by them at any time. Before any such order is made said commissioners shall, after reasonable notice to all parties in interest, give a public hearing in the county where the sawmill to be affected by the order is located, at which hearing any citizen shall have a right to be heard on the questions to be determined by the commissioners. Upon petition of any party aggrieved by such order, filed within six months after the date thereof, the superior court, sitting in equity, may, after such notice as it shall deem sufficient, hear all interested parties and annul, alter or affirm said order. Whoever, having been so notified, discharges sawdust or suffers or permits it to be discharged from a sawmill under his control into a brook or stream in violation of the order of said commissioners, or of said court, if an appeal is taken, shall be punished by a fine of not more than twenty-five dollars.

SECTION 2. Any person aggrieved by an order made by the commissioners on fisheries and game relative to the discharge of sawdust into streams, under the provisions of section eight of said chapter ninety-one, and in force at the date of the passage of this act, shall be entitled, upon application to the commissioners on fisheries and game, to a public hearing and petition to the superior court, as provided in section one hereof.

SECTION 3. This act shall take effect upon its passage. [*Approved May 4, 1906.*]

[CHAPTER 477.]

AN ACT TO PROVIDE FOR THE PROTECTION OF SHELLFISH IN THE TOWN
OF DARTMOUTH.

Be it enacted, etc., as follows:

SECTION 1. No person shall take any shellfish from their beds or wilfully obstruct the growth of any shellfish within the town of Dartmouth, except as is hereinafter provided.

SECTION 2. The selectmen of said town may give permits in writing to any person to take shellfish from their beds within said town at such times, in such quantities, for such uses and by such methods as they shall deem expedient. They shall grant such permits to any inhabitant of the town to take from the beds in said town shellfish for the use of himself and his family not exceeding in quantity one half bushel including shells in any one day. They shall grant such permits to any fisherman to take shellfish from said beds for bait for his own use not exceeding in quantity one bushel including shells in any one day. Such permits shall be signed by the selectmen, shall be recorded in a book kept for the purpose and shall remain in force for one year from their date.

SECTION 3. Every person taking shellfish from their beds within said town under the provisions of this act shall at the time of such taking have with him the permit granted to him as above provided and shall exhibit it upon demand to any constable of the town or other officer charged with the duty of enforcing the provisions of this act.

SECTION 4. No person shall take from their beds in said town or sell or offer for sale or have in his possession any little neck clams or quahags measuring less than one and one half inches across the widest part.

SECTION 5. Whoever violates any provision of this act shall be punished by a fine of not less than ten or more than one hundred dollars.

SECTION 6. The third district court of Bristol shall have concurrent jurisdiction with the superior court of all offences under this act.

SECTION 7. So much of section eighty-five of chapter ninety-one of the Revised Laws as is inconsistent herewith shall not apply to the town of Dartmouth. [*Approved June 14, 1906.*]

[CHAPTER 482.]AN ACT TO AUTHORIZE THE SHOOTING OF MALE MONGOLIAN, ENGLISH
AND GOLDEN PHEASANTS DURING THE OPEN SEASON FOR QUAIL.

Be it enacted, etc., as follows:

SECTION 1. Any person may shoot any male Mongolian, English or golden pheasants during the open season for quail.

SECTION 2. This act shall take effect upon its passage. [*Approved June 14, 1906.*]

Resolves of 1906.

[CHAPTER 74.]

RESOLVE TO PROVIDE FOR AN INVESTIGATION AND REPORT BY THE COMMISSIONERS ON FISHERIES AND GAME AS TO SCALLOPS AND LOBSTERS.

Resolved, That the commissioners of fisheries and game be authorized and directed to investigate and report upon the life history, feeding and breeding habits of scallops and lobsters, and to make any investigations which may assist in devising methods of commercial propagation of these animals, or of increasing the market supply. The said commissioners are authorized to establish and adequately protect structures and areas of land or water wherein such animals may be kept under observation, and to protect animals or material contained therein, and to erect or lease such areas of land or water, buildings, boats or other structures, as in their opinion may be necessary for the proper pursuit of the above objects. Said commissioners may expend for the purposes of this resolve a sum not exceeding fifteen hundred dollars a year for a period of three years. [*Approved May 24, 1906.*]

[G.]

RETURNS FROM THE SHORE POUND AND NET FISHERIES FOR 1906.

Apparatus employed.

PROPRIETOR.	TOWNS.	Number of Men.	Boats.	Value.	Pounds.	Value.	Nets.	Value.
E. C. Jerauld,	Barnstable,	12	4	\$1,100 00	2	\$2,500 00	—	—
Edward Holway,	Bourneville,	2	3	50 00	1	100 00	—	—
Harry M. Alexander,								
Timothy W. Black,								
J. Eldredge & Son,								
Arthur S. Hall,	Brewster,	22	18	675 00	23	5,250 00	8	\$105 00
J. F. Higgins,								
David A. Newcomb,								
Fred Young,								
Gilbert Ellis,								
George N. Bearse,								
G. W. Bloomer & Son,								
Consolidated Weir Company,								
George J. Crowell,	Chatham,	24	16	4,595 00	8	7,550 00	60	740 00
George F. Nickerson,								
R. A. Nickerson,								
Albert Smith,								
E. C. Flanders & Co.,								
D. W. West,	Chilmark,	16	14	1,270 00	8	5,000 00	—	—
W. F. Flanders,								
George A. Finney,	Chiltonville,	3	3	615 00	2	2,500 00	—	—
Allen R. Norton, agent,	Cottage City,	1	—	—	—	—	—	—
D. F. Loring,	Cummaquid,	1	1	10 00	—	—	—	—
A. B. Veeder & Co.,	Cuttyhunk,	4	6	2,160 00	1	1,500 00	—	—

[illegible]

Apparatus employed — Concluded.

PROPRIETOR.	TOWN.	Number of Men.	Boats.	Value.	Pounds.	Value.	Nets.	Value.
James F. Atkins,								
Stephen F. Atwood,								
R. W. Cook,								
Alton L. Daggett,								
C. H. Emery,								
J. H. Emery,								
Prince Freeman,								
James W. Fuller,								
Luther P. Hatch,								
A. P. Lewis and Manuel James,								
John Johnson,								
James E. Kelley,								
R. A. Kelley,								
Fred A. Lewis,								
Thomas J. Lewis,								
William B. Lewis,								
A. A. Mayo,								
H. L. Mayo,								
John O. Neil,								
Frank V. Perry,								
Richard Rider,								
Frank I. Sears,								
John F. Silva,								
Edwin Smith, Jr.,								
H. N. Smith,								
John S. Smith,								
W. C. Snow,								
John R. Swartz,								
Isaac Tyler,								
Manuel Vera,								
William Wareham,								
J. W. Weeks,								
J. R. Williams,								
J. P. Woods,								
J. K. Cobb,								
Conwell Bros.,								
William Josephs,								
Manuel Carter,								
J. W. Sears,								
	Provincetown,	97	102	\$26,896 50	13	\$24,400 00	1,032	\$9,557 00

Melvin Rich,	1	2	206 00	—	—	18	90 00
G. B. Williams,	18	5	125 00	—	—	2	150 00
Charles G. Bigwood,	—	—	—	—	—	5	23 00
George H. Morgan,	—	—	—	—	—	—	—
John Elvander,	—	—	—	—	—	—	—
E. W. Haines,	—	—	—	—	—	18	145 00
Chas. H. Parker,	—	—	—	—	—	—	—
A. N. Goff,	6	2	30 00	—	—	2	100 00
George F. Edson,	—	—	—	—	—	6	75 00
J. H. Miller,	10	3	130 00	—	—	2	200 00
Benj. Cleveland,	—	—	—	—	—	2	35 00
H. W. Daggett,	1	1	15 00	—	—	5	—
O. S. Daggett,	—	—	—	—	—	—	—
George H. Luce,	—	—	—	—	—	—	—
H. N. Luce,	29	36	1,745 00	18	7,800 00	—	—
George W. Manter,	—	—	—	—	—	—	—
J. A. Mayhew,	—	—	—	—	—	—	—
W. L. and G. F. Tilton,	—	—	—	—	—	—	—
John R. Walker,	—	—	—	—	—	—	—
W. W. Freeman,	28	16	3,320 00	10	25,000 00	10	50 00
Atkins Hughes,	—	—	—	—	—	—	—
George Cleveland,	—	—	—	—	—	—	—
Otis B. Luce,	4	11	1,215 00	8	3,200 00	3	80 00
David B. Smith,	—	—	—	—	—	—	—
Eben Luce,	—	—	—	—	—	—	—
William P. Doane,	4	3	20 00	1	200 00	5	48 00
B. S. Paine,	—	—	—	—	—	—	—
J. F. Rich,	2	6	1,200 00	1	400 00	—	—
John J. Veeder,	3	2	15 00	—	—	1	35 00
Hiram E. Baker,	—	—	—	—	—	—	—
Totals for State,	430	372	\$69,400 50	115	\$110,660 00	1,641	\$19,591 50

Number of Pounds of Fish taken

Town.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Salmon.	Seap.
Barnstable, . . .	-	-	3,800	140,640	-	5,300	-	-
Bourne, . . .	-	-	-	26,821	-	508	-	-
Brewster, . . .	19,810	108	27,116	4,538	-	240	-	-
Chatham, . . .	6,607	460	26,900	143,143	1,000	2,153	-	6,700
Chilmark, . . .	50	-	3,570	3,460	-	300	-	15,670
Chiltonville, . . .	-	-	-	19,819	-	-	-	-
Cottage City, . . .	-	-	-	-	-	-	-	-
Cummaquid, . . .	-	-	-	-	-	-	-	-
Cuttyhunk, . . .	-	-	-	-	-	-	-	-
Dennis, . . .	88,100	4	10,000	4,000	-	53,000	-	81,000
Dighton, . . .	113,200	-	18,750	18,065	-	200	-	1,050
Edgartown, . . .	300	-	-	-	-	-	-	-
Gay Head, . . .	-	-	3,100	10,618	-	-	135	2,850
Gloucester, . . .	-	-	480	4,480	-	12,600	-	32,800
Harwich, . . .	52,000	-	85	61,471	600	463,875	-	156
Hyannis, . . .	-	-	4,100	-	-	-	-	-
Manchester, . . .	1,000	3,706	-	7,529	16,700	-	-	2,000
Nahant, . . .	7,100	-	-	29,975	-	55,100	-	-
Nantasket, . . .	700	300	-	81,620	-	3,847	-	-
Nantucket, . . .	-	-	-	300	-	-	-	-
Newburyport, . . .	-	35,617	2,866	112,309	-	205,300	-	87,450
Provincetown, . . .	-	-	-	27,894	-	5,567	-	-
Rockport, . . .	-	191	634,337	332,348	-	528,244	9	-
Raynham, . . .	-	-	-	130	-	2,702	-	-
Salem, . . .	50,000	-	-	-	-	-	-	-
Sandwich, . . .	-	-	128	-	-	-	-	-
Segregansett, . . .	-	-	-	3,269	-	-	-	-
Scituate, . . .	40,000	-	-	-	-	-	-	-
Somerset, . . .	-	-	-	293	-	-	-	-
Swansea, . . .	32,500	-	-	-	-	-	-	-
Tisbury, . . .	400	-	500	-	-	-	-	-
Truro, . . .	10,000	2,150	25,050	9,400	225	11,200	-	20,100
Vineyard Haven, . . .	-	-	47,785	175,455	-	296,360	-	975
Wellfleet, . . .	6,000	-	3,831	1,444	-	71	-	6,587
Woods Hole, . . .	-	-	-	-	900	-	-	-
Yarmouth, . . .	10,000	-	-	-	-	-	-	-
Totals for State, .	33,000	-	-	-	-	-	-	-
Totals for State, .	486,467	42,536	812,398	1,219,021	19,425	1,645,567	144	257,383

in Nets, Pounds, Traps, etc.

Sea Bass.	Sea Herring.	Shad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Refuse Fish.	Total Value.
-	150	800	123,750	-	10,400	1,950	41,100	-	\$13,461 00
-	-	2	3,976	-	5,400	1,239	4,659	-	2,020 83
13,736	98,578	-	137,659	83	17,525	1,198	36,115	742	6,966 13
-	4,500	3,408	210,962	-	41,000	54	30,635	-	14,619 09
200	-	-	190,204	-	-	-	1,480	-	7,832 65
-	-	-	10,300	-	-	-	1,100	-	1,447 67
-	-	-	-	-	-	-	100	-	15 75
-	-	-	-	-	-	-	3,300	-	140 00
14,000	-	-	95,000	-	-	3,000	55,000	-	8,487 00
-	15,900	-	150,731	4,100	193,765	1,585	69,775	-	10,065 88
-	-	10,587	-	-	-	-	11,700	-	2,814 00
25	-	9	15,246	-	1,000	-	1,785	-	1,206 84
800	-	-	160,155	-	1,000	-	7,400	-	10,204 75
-	197,940	30,595	20,000	-	125	65	319,230	-	11,676 14
-	-	-	-	-	-	-	-	-	67 40
-	-	-	13,548	107	18,540	100	-	-	2,343 46
-	49,200	724	410	-	-	58	168,256	-	2,962 35
-	734,250	-	369	-	2,200	-	155,331	-	11,585 90
-	-	-	-	-	-	-	-	-	20 00
-	-	200	61,416	-	-	-	114,809	-	23,270 92
-	167,000	-	-	-	-	-	287,514	-	6,207 04
-	1,148,570	-	115,789	-	45,700	-	2,138,405	-	61,672 48
-	5,325	-	-	-	-	-	12,973	-	330 50
-	-	2,256	-	-	-	-	-	-	805 48
-	1,541	-	-	-	-	-	-	-	33 56
-	-	-	6,221	-	-	20	1,065	-	320 55
-	-	1,080	-	-	-	-	-	-	530 00
-	-	-	-	-	-	-	-	-	60 45
-	-	125	-	-	-	-	-	-	345 50
-	-	-	800	-	-	-	3,567	-	353 00
1,030 ³	200	900	412,284	315	4,200	2,800	1,700	20,000	14,116 04
2	652,350	-	202,050	-	60,500	-	1,294,185	-	33,333 55
304	16	-	87,468	-	3,200	-	8,015	-	3,305 17
-	-	-	1,923	-	-	-	1,200	1,300	241 06
-	-	-	7,100	-	4,000	500	-	-	491 00
-	-	-	-	-	-	-	-	-	330 00
20,095	3,075,520	50,686	2,027,361	4,605	408,555	12,569	4,770,399	22,042	\$253,683 14

Edwin H. Crowell,	.	.	.	.	.	7	10	750 00	415	530 00	9,217	1,974 95	117
James Cunningham,	.	.	.	.	.			
W. A. Smith,	.	.	.	.	.			
C. W. Taylor,	.	.	.	.	.			
G. H. Lamphier,	.	.	.	.	.			
Warren P. Taylor,	.	.	.	.	.			
Chas. A. Bridgham,	.	.	.	.	.			
George L. Hatch,	.	.	.	.	.	5	6	235 00	261	505 00	7,222	1,788 55	290
Henry E. Hatch,	.	.	.	.	.			
Ephraim Onderkirk,	.	.	.	.	.			
Simon Rogers,	.	.	.	.	.			
E. C. and J. E. Chapel,	.	.	.	.	.			
J. H. Dennis,	.	.	.	.	.			
Harry E. Dunham,	.	.	.	.	.	9	16	1,585 00	224	208 00	3,393	863 16	150
Chas. C. Eldredge,	.	.	.	.	.			
Wm. H. Hamblin,	.	.	.	.	.			
Joseph Ray,	.	.	.	.	.			
J. S. Watkins,	.	.	.	.	.			
Chas. P. Matteson,	.	.	.	.	.	3	5	630 00	165	180 00	3,384	892 98	101
Bartholomew Silva,	.	.	.	.	.			
George B. Taber,	.	.	.	.	.			
Caleb Hayden,	.	.	.	.	.	3	3	540 00	59	66 00	1,107	422 00	9
Daniel B. Gould,	.	.	.	.	.			
J. H. Bagnall,	.	.	.	.	.			
H. J. Caswell,	.	.	.	.	.			
Frank Glass,	.	.	.	.	.	5	12	745 00	323	412 50	11,654	2,443 05	63
A. S. Hadaway, Jr.,	.	.	.	.	.			
J. P. Thurston,	.	.	.	.	.			
C. H. Emery,	.	.	.	.	.			
George W. Freeman,	.	.	.	.	.			
J. H. Little,	.	.	.	.	.			
J. C. Lurten,	.	.	.	.	.	10	11	675 00	342	339 00	6,335	1,733 56	222
Martin Nelson,	.	.	.	.	.			
Joseph S. Perry, Jr.,	.	.	.	.	.			
Richard Rider,	.	.	.	.	.			
W. C. Snow,	.	.	.	.	.			
Arthur Chandler,	.	.	.	.	.			
Arthur Gibbs,	.	.	.	.	.	3	4	110 00	83	63 00	1,171	224 06	48
P. H. Marsh,	.	.	.	.	.			
C. H. Berry,	.	.	.	.	.			
Chas. G. Bigwood,	.	.	.	.	.			
Chas. S. Brown,	.	.	.	.	.	6	8	595 00	397	545 00	12,863	2,951 10	402
John A. Dunn,	.	.	.	.	.			
George H. Morgan,	.	.	.	.	.			

REPORT
OF THE
COMMISSIONERS
ON
FISHERIES AND GAME
FOR THE
YEAR ENDING DECEMBER 31, 1907.



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Commonwealth of Massachusetts.

To His Excellency the Governor and the Honorable Council.

The Commissioners on Fisheries and Game respectfully submit this their forty-second annual report.

GENERAL CONSIDERATIONS.

Appropriations. — The exact details of all expenditures are published in the annual report of the Auditor of the Commonwealth. Summarized, \$6,474.43 was expended for the benefit of the sea and shore fisheries, \$6,135.06 for maintenance of inland resources for the purchase, propagation and distribution of food fish, for the purchase, propagation and distribution of game birds (pheasants) and for the purchase and propagation of quail and ruffed grouse; for the enforcement of the fish and game and bird laws on land and sea \$26,765.93 was expended; \$5,630 for salaries of the three commissioners; and \$4,440.90 for printing, postage, travelling expenses of the commissioners and for clerical and office expenses. The total amount of fines was \$3,470.20.

Duties. — The work of the department must be mainly altruistic. The commissioners have large responsibilities, since it is their peculiar duty to act through their special knowledge and training as the accredited official advisers of citizens, corporations, municipalities, State, legislative and executive officials, upon questions of past or proposed legislation which involve problems relating to the natural history of our fish, mollusks, lobsters, birds and mammals, their relations to the environment, including their direct and indirect bearing upon the public weal, and how they may be most efficiently utilized for the benefit of all. With undivided purpose we aim to fur-

nish definite, authoritative, reliable and unprejudiced opinions upon State, municipal or private practices connected with the utilization, development and maintenance of our natural resources in the marine and inland fisheries and shellfisheries, and of our birds and mammals.

In addition to enforcing the fish and game laws in all sections of the State (except Buzzards Bay, where the enforcement of the fish and game laws continues under the State Police), the commissioners and their deputies seek to secure and disseminate information, and to indicate desirable methods of dealing with fish and game problems, thereby pointing out increased possibilities for economic gain through a better knowledge of nature's laws; to act as a clearing house for ideas; a board of conciliation and arbitration in cases where interests of farmers, fishermen, sportsmen and recreationists clash upon questions of the fisheries and game; and to guard against any untoward attempt of any one class to profit at the expense of the many, by preëmpting what are properly natural resources which should continue to be public assets.

Dogfish. — Prominent among the questions to which we have given attention is that concerning the enormous damage annually inflicted upon our sea fisheries by the species of shark commonly known as dogfish. The aggregate damage to Massachusetts fishing interests alone cannot be less than \$5,000,000 in any one year, and affects not alone the fishermen, but the public as well. Federal legislation is most desirable, and will doubtless follow the initiation of the States. If State Legislatures demonstrate willingness to do a share in maintaining their local resources, federal co-operation will be more likely to be secured.

Pacific Halibut Fisheries. — Massachusetts capital and enterprise have done much to develop the Pacific fisheries, and the bulk of our halibut supply is now brought in bond in refrigerator cars from Vancouver to Boston. The commissioners have for the benefit of Massachusetts interests recently made a brief study of the conditions involved.

Shellfisheries. — During the past three years a large portion of our time has been occupied in devising methods for ascertaining facts of economic importance concerning the now deca-

dent shellfish industries of the State and practical methods for their rehabilitation. The clam, oyster and scallop fisheries have been an important factor in the food supply of the Indians and the colonists. Even the present generation can recall the abundance and the importance of the natural clam, oyster and scallop fisheries, and has likewise seen the decline. The work of investigation has been laid out on a broad scale, and has been carried to such a degree as now to warrant a detailed report. (See page 25.) The general results indicate clearly that the decline is due to unsystematic digging, which is made possible by laws which fail to fulfill the purpose for which they were enacted. These laws, in addition, are obscure on several important points. We feel warranted in saying that the present shellfish laws are entirely inadequate to permit a satisfactory yield of shellfish, or to guarantee proper protection to labor or to capital invested in these shellfisheries. Several other States have recently enacted complete new codes of shellfish laws, adapted to modern conditions, and the results have been of remarkable value to the State and to all interested in any manner or degree. Under the present laws, one of the Commonwealth's most valuable assets has been permitted to lapse. We are prepared to demonstrate that the areas below low-water mark can be made to produce food material of equal if not greater value to man than similar areas of agricultural land under the most intense methods of cultivation; that the net income should average \$200 per acre, and under the most favorable conditions may reach \$1,000 per acre, annually; that the income on the capital frequently exceeds 100 per cent. a month during the summer, and in isolated cases even 1,800 per cent. per year. To supply our permanent markets shellfish are brought even from Prince Edward Island, and the increasing number of summer residents along Massachusetts' shores find great difficulty in securing a satisfactory local supply. We find that at least 20,000 acres suitable for the cultivation of clams, quahaugs and oysters are lying barren; 6,000 acres of first-class clam flats are producing practically nothing; while our entire yield of soft clams comes from 2,000 acres, and even of this but a very small proportion is producing the maximum potential yield. Few States are so fortunately provided with local markets quickly accessible for such a wide

variety of shellfish. Under the present laws, by which the control is entrusted to the mayor and aldermen of cities or to the selectmen of the coast towns, the sum of the practical efforts has been almost solely directed to restricting the demand through the medium of close seasons, limitation of daily catch, size limit, etc., rather than to increasing the supply by study of the problems involved and the application of the remedies. In the present day, when the cost of food weighs heavily on the community, the Commonwealth must not permit these productive resources to remain longer idle.

Lobster Fisheries. — The passage of the law making legal the killing of lobsters above 9 inches long has led to an increase in the number of lobster fishermen, and extends still farther the fundamental biological blunder of permitting the capture of lobsters during their breeding age. Again we repeat our warning that commercial extinction of the lobster in Massachusetts waters is imminent unless the present laws are modified to such a degree as to secure protection to the lobsters of breeding age, in order that a larger number of eggs may be produced annually. (For a full discussion see page 12.)

Inland Fisheries. — During the past season our brooks and rivers showed more conspicuously than ever the disastrous effects of the denudation of hillsides by woodcutters and forest fires. In the unusually low water of the winter of 1906 and 1907 many streams were frozen solid, and millions of young trout and the animals which serve as trout food were destroyed. Subsequent floods swept many of the remaining young trout down stream, to be devoured by the larger fish. The floods impaired the spawning grounds. The summer drought completely dried up the smaller streams. As a whole, the year has been disastrous to the young brook trout. Yet the fact that before many years our forest and cultivated land will come more nearly into equilibrium, with a diminished annual completely destructive denudation, and therefore a lesser variation in the volumes of high and low water in the streams, gives strength to our belief that with efficient methods the inland fisheries of the State may be maintained in a condition to yield a goodly amount of food and recreation to an increased population. Our present facilities for rearing fish for stocking are insufficient to meet the demands

properly and economically. Our activities in this direction are detailed on page 27.

Game. — For the chief game bird, the ruffed grouse or partridge, the present breeding season has been exceedingly unfavorable, due to a combination of causes: an inclement spring, coupled with an ever-increasing number of enemies, notably cats, foxes, infectious diseases, dogs and hunters, and a rapidly progressive destruction of the covers. Man is largely responsible for the introduction of many conditions prejudicial to the wild creatures, but with adequate forethought and improved knowledge man may in a large degree apply adjustive measures. The demands made upon all our species of game are unusually heavy, for the reason that practically all the shooting grounds are made remarkably accessible through the wide extension of trolley lines and State highways. The automobile now permits the hunter to cover far wider areas than formerly, and with improved guns and thoroughly trained dogs he lays annually a heavier tribute upon all species of game. Excessive shooting, both legal and illegal, because more conspicuous and therefore more readily controlled, is, perhaps, less dangerous to the permanence of the annual crop of game than are the insidious attacks of carnivorous animals, such as the goshawk and Cooper's hawk, among the birds of prey; the skunk, red squirrel, mice, fox, and particularly the domestic cat, among the mammals; and the still more obscure infectious diseases to which all birds are susceptible. Our investigations indicate that the ruffed grouse, quail and turkey are particularly susceptible to an intestinal parasite, *Amæba melæagridis*, apparently spread by domestic hens. Hens, and, so far as we know, pheasants, are generally immune from any obvious effects; but when the hens infect the ground with this parasite it results in a disease known as *Enterohepatitis*, or "black head," notoriously fatal to turkeys, and by us found to be even more rapidly fatal to ruffed grouse and quail. The Bureau of Animal Industry at Washington have investigated fatal infectious disease among southern quail. The majority of the quail purchased by the commission in Alabama for breeding purposes were found to be infected with this chicken-cholera-like bacillus. Fortunately, these birds were kept in quarantine and under observation, so that all our breeding pens

were not infected. We are informed that many southern quail were liberated in the State last spring by individuals and associations, without a quarantine. Such hasty action is greatly to be deplored, and should be carefully avoided in the future, as the probability of infecting whatever remains of our native game birds is strong. There is, too, the possibility of introducing disease with such foreign species as the European partridge, migratory quail, black cock, Scotch grouse, pheasants, etc. In our experience with the pheasants we have not found a case of "black head," but many young die from infection with the microscopic *Coccidium avium*. This parasite, however, is by no means peculiar to the pheasants, but has been reported in upwards of twenty species of domesticated and wild birds. A lot of quail quarantined upon arrival in a pen long tenanted by pheasants contracted the *Coccidium* disease, and many died from this parasite, with probably other complications.

The results of attempts at rearing game birds in confinement for subsequent liberation in the State are detailed on page 37.

Protection of Insectivorous and Song Birds. — The chief factors in the destruction of our native birds, named in the order of their importance, are cats, English sparrows, alien and market hunters, collectors for millinery purposes, boys with 22-caliber rifles and air guns, private collectors for "birds to set up," the destruction of nesting sites, the Cooper's and sharp-shinned hawks.

Public opinion has not yet realized the annual damage done by some of these, notably the cat, the English sparrow and the destruction of nesting sites. The other factors are at present covered by law. The maintenance of our native birds is one of the most important problems of economic biology. Its solution depends upon an advanced state of public opinion, and upon the co-operative efforts of all classes of people. Birds are slaughtered and sold by millions for millinery purposes. This economic waste can be stopped only by total abstinence from feather fashions, and increased attention to educating the people to a proper understanding of the birds' place in nature.

Shore Birds and Ducks. — The number of these birds breeding in Massachusetts has been tremendously reduced since colonial days. Birds migrate to find a secure breeding ground. In

the absence of spring shooting, many birds would remain here to breed.

The period has arrived when it is necessary to make an earlier date when shooting of all game, whether inland or shore, should cease. It is now legal to hunt for one species or another from July 15 to May 20 following. The laws should be so modified that all shooting of migratory birds should cease December 31.

There are several species of "peeps" which, on account of their beneficent habit of feeding upon mosquito larvæ and other aquatic larvæ of insects, should be protected from the slaughter meted out to them by the near-sportsmen. Too small to be of food-market value, they fill an important place in nature in the mosquito-infested marshes of the south and of the northland.

Foxes, Deer and Game Birds.—An interesting biological chain of events has developed in the State. The general public takes especial pleasure in the sight of wild deer, and objects to the killing of these animals. Without question they are an attractive and valuable asset of the State, and one worthy of consideration. Unfortunately, they are indiscriminate feeders, and the annual damage to farm and garden crops is considerable, though if the damage is carefully analyzed it is but a small fraction of the market or food value of the annual increment of the deer crop. It would be a lucrative business to raise deer by range methods. In some sections of the State deer are not popular with the farmers, unless the deer's carcass may be taken to pay the deer's board bill.

The fox hunters, too, have a grievance. The deer trails disconcert the dogs, and a dog which hunts deer (and nearly all dogs do) may bring its owner to court. The fox hunters claim that foxes have increased in this State because the annoying deer tracks make fox hunting less attractive, and fewer foxes are killed. The full measure of their demands would require extermination of the deer and a close season on foxes.

The poultry farmers, on the other hand, are earnestly demanding a bounty on foxes, on account of the very considerable damage to poultry. While we know of no statistics, it is the writer's opinion that the damage to poultry interests by foxes far exceeds that done by deer to farm and garden crops.

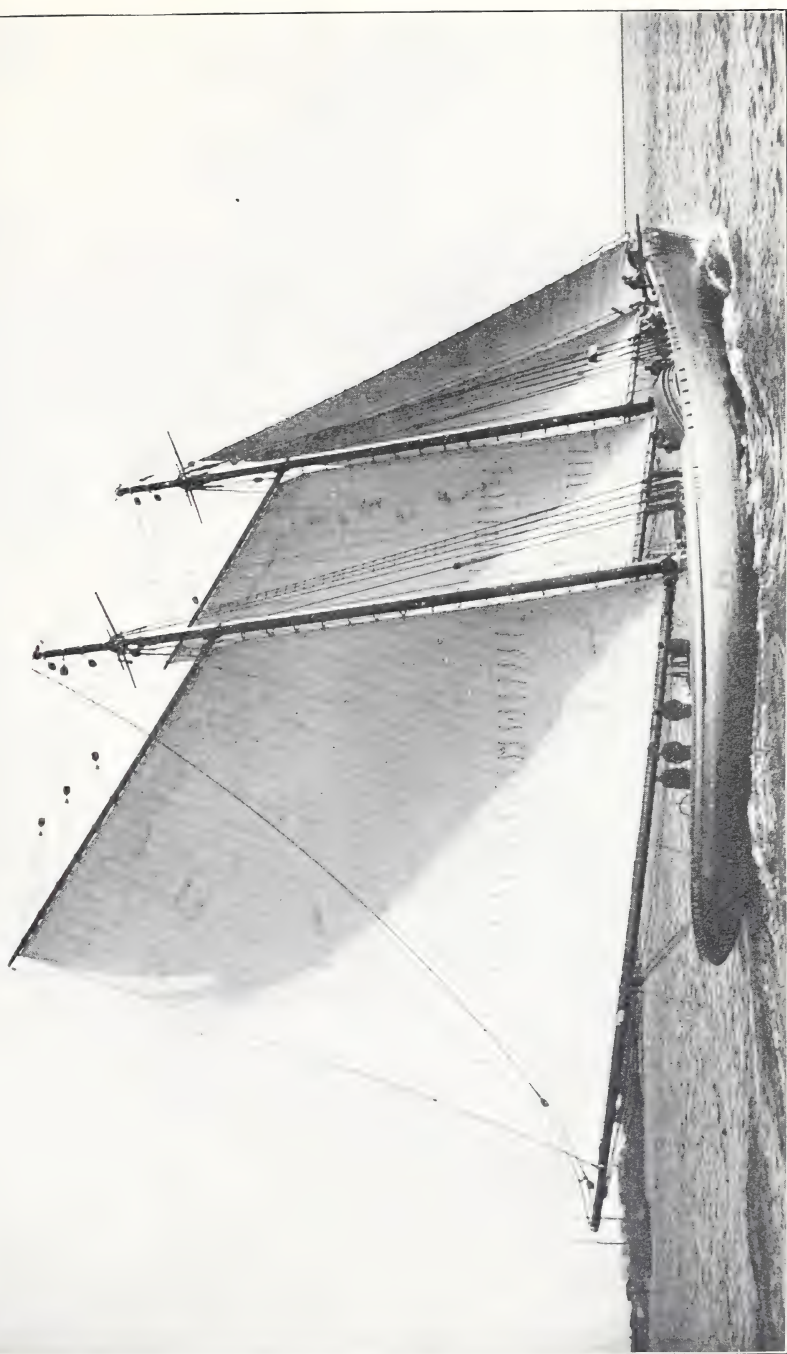
On the other hand, the fox kills enormous numbers of mice,

and thus benefits the farmer by destroying an insidious enemy which levies and collects a tax on farm products far exceeding the farmer's State, county and town tax. The game birds doubtless suffer to some extent by the killing of the adults and young by foxes, and possibly from deer as well as wild mice, which eat the eggs.

The correct procedure must be ascertained whereby the numbers of deer and foxes can be limited to approximately the number which our wild lands can support, and any excessive over-population which tends to enter cultivated land must be eliminated in such a manner as to give no special privileges, but yield a public revenue. A general hunting license law should be enacted, covering all resident hunters, to supplement the alien and non-resident hunting licenses now in force. The fee for non-residents should be \$10, and for residents it should be nominal, *e.g.*, \$1 for small game, with an additional fee in each case of \$15 if a license to shoot one deer was desired.

Enforcement of Law. — The most prominent offences against the fish and game laws are illegal hunting by aliens, and Sunday hunting. In the former case the law is difficult of enforcement, for the reason that it is extremely difficult to ascertain with certainty whether any foreigner who is found in the woods is or is not naturalized, unless he can be made to identify himself. The passage of a general hunting license law would increase the efficiency of this and other laws and of our deputy service. The Sunday hunting law would be improved by a legal definition of what constitutes hunting. Many judges rule that the pursuit of living animals, either with or without a gun, with intent to injure or kill, or the presence on the hunting ground with a gun, whether loaded or not, or with a hunting dog, is sufficient ground for conviction.

We have endeavored to enforce the laws with intelligence and justice to all. Even an efficient officer cannot expect unanimous approval, for there is an extremely wide diversity of opinion concerning methods of enforcing the fish and game laws. We believe that the increase in the number of paid deputies to twenty-four has been wise, and that there has been a lesser number of violations. On the other hand, the violators are



THE "ARETHUSA." — The New Knockabout Type of Gloucester Fishing Vessel.

studying more carefully the letter of the law, and are constantly developing new methods of evasion. A law requiring a person hunting to show to the officer, when requested, all the game in possession, would greatly benefit the honest hunter and the public. The useful birds so numerous shot by aliens are of such small size as to be readily concealed, and under the present laws the great majority of such cases cannot be successfully dealt with.

The moiety system, whereby the fines are equally divided between the complainant and the Commonwealth, has led to such flagrant abuses that we most emphatically call renewed attention to our statements of last year:—

The experience of another year has still further demonstrated the undesirable conditions which may prevail under a law which exposes deputies appointed for the enforcement of law to the temptation of seeking prosecutions under the stimulus of half the fines secured by their activity. Such a system is pernicious, and cannot fail to result in many instances of service discredited and justice prostituted.

With but a few isolated exceptions, our unpaid deputies undertake the work in the purest and cleanest spirit of public service, and often at a considerable sacrifice of time and money. Unfortunately, each year there appear several instances where the mighty dollar or personal spite are the moving features in prosecutions.

MARINE FISHERIES.

The Deep Sea Fisheries.—The past year has been a prosperous one for Massachusetts' oldest industry. The general record has been a catch well above the average of recent years, with a ready market at good prices. There have been no remarkable developments. Some improvements in methods of marketing fish have been devised. Of fishing vessels, the knock-about type, furnishing a craft more easily handled in rough seas, better fitted to withstand tremendous strains in the bow rigging and giving more room forward, appears to be coming into distinct favor. It is a remarkable tribute to the Gloucester type of fishing vessel, and to the seamanship of the crews, that again we are able to record the fact that not a single

Massachusetts fishing vessel has foundered, in spite of the daring trips in distant seas, even as remote as Davis Strait and the waters of western Greenland.

Our commercial fishing relations in Newfoundland and in Canadian waters are not yet completely and definitely adjusted.

In the evolution of the fishing industry Gloucester has come to be the market for salt fish, while Boston is the chief market for fresh food fish.

The aggregate of fish landed at Gloucester and Boston in 1907 was 197,990,995 pounds, as compared with 183,509,654 pounds in 1906.

The Gloucester Fisheries. — The total weight of fish landed from Gloucester vessels at that and other ports in 1907 was 148,979,859 pounds, as compared with 128,087,284 pounds in 1906, or a net gain of over 20,000,000 pounds.

Codfish. — The rip fleet found unusually good fishing, and on account of the high prices less than usual went to Gloucester for salting. Many of the salt bankers omitted their usual second trip. The total catch, particularly of small fish, for some of which credit should be given to the activities of the local hatcheries of the Bureau of Fisheries, reached the very handsome total of 12,689,295 pounds, valued at \$325,011, compared with 11,883,613 pounds in 1906, valued at \$253,001.

The shore catch of cod has also been extremely satisfactory. The fish are coming so close to shore that the Italian power dories fishing about the lightship off Boston harbor are reported to frequently take 500 to 5,000 pounds of cod, mostly of fair size, 5 to 9 pounds, and considerably greater quantities of haddock and other fish.

Among the high liners are noted: —

Schooner "W. H. Moody," Capt. Andrew Gorveneau, who in the Georges handline cod fishery stocked \$14,000.

Schooner "Elector," Capt. Clayton Morrissey, who in the salt bank trawl cod fishery stocked on two trips \$19,200; and schooner "Hazel R. Hines," Capt. Lovitt E. Hines, on two trips, \$18,000.

Schooner "Tattler," Capt. Alden Geel, engaged in salt bank cod fishery (dory handlining), sailed from Gloucester July 2, 1907, fished on Quero Bank, and returned to port Sept.

17, 1907, having been gone the remarkably short time of eleven weeks. As a result of this trip, she weighed off the enormous aggregate of 447,827 pounds of salt cod, on which a stock of \$17,206.62 was made. The vessel carried a crew of 27 men. The high line share was \$406.75, and the average share \$308.92. It was the largest dory handline salt cod trip ever landed, and it is also claimed that no trawl salt cod fare ever equalled it. The stock was the largest ever made on a salt cod fishing trip, and, considering the short time the vessel was gone and the enormous money return received, it was the most notable salt fishing trip ever landed.

Mackerel.—The catch of the present year was a pleasing contrast to that of 1906, when the catch was the smallest on record, with one exception, since 1814. The general catch of Massachusetts vessels is considerably greater than last year. But higher prices made a still more satisfactory yield to the fishermen and vessel owners. Again Capt. Sol Jacobs was the first arrival at Fortress Monroe, Va., landing 3,500 medium fish on April 25, which sold at 25 cents each. The total catch of mackerel by Massachusetts vessels was: fresh, 56,169 barrels; salt, 31,396 barrels; as compared with 1906: fresh, 35,240 barrels; salt, 10,138. The best stocks were:—

VESSEL.	Captain.	Gross Stock.
"Grayling,"	Joseph Smith,	\$28,000
"Constellation,"	Thad. Morgan,	26,000
"Ingomar,"	Wallace Parsons,	25,113
"Slade Gorton,"	George Heckman,	23,400
"Saladin,"	Flor. McKnown,	20,471

The high line vessel of the Gloucester fishing fleet for 1907 was schooner "Slade Gorton," Capt. George Heckman, with a stock of \$39,400, made in the haddock fishery and the mackerel seining fishery.

Schooner "Lucania," Capt. Martin L. Welch, stocked in 1907 \$38,000 in mackerel seining and haddock fisheries.

Halibut.—The Georges fishermen located fewer halibut than usual. The receipts of fresh Atlantic halibut at Boston were

356,620 pounds less than in 1906. The Grand Banks fleet encountered an unusual amount of bad weather. Though the aggregate catch was smaller by nearly a million pounds, some notable fares were made.

The Boston "Globe" of Feb. 9, 1907, says:—

Capt. Robert B. Porper of the schooner "Cavalier" has achieved one of the record-breaking stocks in the history of the local halibut fishery.

He arrived here Thursday from the Grand Banks with a fare of 63,000 pounds of halibut and 12,000 pounds of salted codfish, after an absence of about four weeks.

The stock aggregated \$5,063, which, after the vessel's share had been deducted, gave each of her crew of 20 \$114.35 as their individual share of the voyage. The amount realized has not been exceeded a half-dozen times in the history of the halibut fishery, in the times when such well-known masters as Nathaniel Greenleaf, Alexander Griffin, William MacDonald, William Thompson, Thomas Hodgdon and others were in the forefront of this once profitable branch of New England's fishing industry.

Captain Porper, who is one of the best-known master mariners from this port, is making a record, devoting his attention exclusively to his vocation of halibut fishing, both winter and summer.

The best stocks were:—

IN BANK HALIBUTING.

Schooner "Cavalier," Capt. Robert Porper, stock for 1907, \$25,-986.61; largest stock ever made in this branch of the fisheries.

Schooner "Monitor," Capt. John McKay, stock for 1907, \$24,147; also a remarkably big stock, and second only to the "Cavalier's."

GEORGES HALIBUTING.

Schooner "Kineo," Capt. John G. Stream, stock for season of 1907, nine months, \$26,200.

FLITCHED HALIBUTING.

Schooner "Admiral Dewey," Capt. James Hayes, stock for season of 1907, one trip of five months, \$14,188.

Schooner "Henry M. Stanley," Capt. Henry Arsenault, stock for season of 1907, one trip of five months, \$12,883.75.

Lobster.—The decrease in the lobster supply continues. Becoming first apparent in the regions nearest the markets, the circle of scarcity continually widens. With the increased de-

mands comes the stimulus to seek new and necessarily more remote grounds. The past summer has been notable for the exploitation of regions as far distant as Cashes Bank. It is reported that about July 10 the schooner "J. R. Atwood," owned by J. A. Young & Co., was fitted out for a lobstering trip to Cashes Bank. It was stated that 5 men, with 100 pots hauled daily, with exceptionally favorable weather, caught 220 lobsters, weighing about $2\frac{3}{4}$ pounds each, on the average, and the sharesmen cleared \$92 apiece on the venture. It seems probable that lobsters resort to the shallow waters of Georges and other banks to hatch their eggs and to moult. This region, hitherto unexploited, may be the nursery whence our supply is being maintained, and with the destruction of the breeding lobsters in this region the decrease in the market supply will become still more accelerated. For, looking at the matter how we will, no man can gainsay the fact that the lobster has almost completely disappeared from wide areas where it was formerly abundant, and that the Massachusetts catch has become an almost negligible factor in the Boston market supply. A résumé of the sworn reports of the fishermen indicates this:—

YEAR.	Fishermen.	Traps.	Lobsters.	Average Catch per Pot.	Egg Lobsters.	Ratio of Egg Lobsters to Total Catch.
1890, . . .	479	19,544	1,612,129	82	70,907	1 : 22
1906, . . .	335	21,918	487,332	22	9,378	1 : 52
1907, . . .	379	21,342	1,034,886	49	10,348	1 : 100

These figures indicate that in 1890 the fishermen used on the average about 40 pots per man, and caught 82 lobsters per pot; while in 1906 they used on the average about 65 pots per man, and caught 28 lobsters per pot. There is also convincing testimony that the average size and weight of the lobsters caught have continually diminished. But most serious of all is the fact that the relative number of breeding lobsters has declined. Whereas in 1890 there was 1 lobster carrying eggs to every 22 in the total catch (or about $4\frac{1}{2}$ per cent.), in 1906 there was only 1 egged lobster to every 52 in the general catch (or less than 2 per cent.), while in 1907 the ratio fell to 1 in every 100.

This fact seems to prove that the reproductive capacity of the race has been correspondingly diminished, and that in 1890 this reproductive capacity was at least two and one-half times that in 1906. The decline between those dates was so gradual as to escape attention. That such a serious reduction in the number of eggs laid annually causes inevitably a decreased number of young lobsters which in time would become breeders, and that therefore the maintenance of our lobster supply is primarily dependent upon the number of eggs produced, is perfectly obvious, and it remains only to ascertain the causes which contribute to this reduction in the annual crop of lobsters. The chief cause is the destruction of the adults of breeding age. The following table covers our observations upon the measurements of 6,159 egg-bearing lobsters during the past two years. It will be seen that of this total number of lobsters bearing eggs but 423 were below $10\frac{1}{2}$ inches long, and a still smaller number, 7, were less than 9 inches long. The majority of the breeding lobsters were above $10\frac{1}{2}$ inches long, therefore the law passed in 1873 and copied by the other States embodied a wrong biological principle, inasmuch as it encouraged the destruction of the lobsters of breeding age, *i.e.*, those above $10\frac{1}{2}$ inches long. The still more pernicious law of 1907 greatly increased the destruction of adults, since it legalized the killing of those above 9 inches. The chief argument in favor of this 9-inch law was that no more lobsters would be killed, but that it would, by thus legalizing the widely existing practice of killing the "shorts" as well as the larger lobsters, place the honest and dishonest fishermen on a plane of equal opportunity for gain. The fatal defect of any law based upon size measurements, or which permits the *capture* of those of illegal size, is that it can be enforced only by the presence on the fishing grounds of a large number of officers and boats.

Table showing Measurements of Egg-bearing Lobsters collected by Launch "Egret" during 1906 and 1907, with Number of Each Size.

Size (in Inches).	Number.	Size (in Inches).	Number.	Size (in Inches).	Number.	Size (in Inches).	Number.
7¾	1	10¼	75	12¾	383	15¼	6
8	1	10½	534	13	572	15½	12
8¼	1	10¾	287	13¼	152	15¾	2
8½	1	11	684	13½	176	16	7
8¾	3	11¼	268	13¾	80	16¼	1
9	14	11½	530	14	161	16½	5
9¼	10	11¾	286	14¼	20	16¾	2
9½	67	12	72	14½	42	17	3
9¾	49	12¼	760	14¾	16	18¼	1
10	201	12½	642	15	31	19¼	1
Total,							6,159

To secure the optimum value of our lobster fisheries, a close season for a term of not less than five years is necessary, in order that there may be a small measure of recovery from the destructive methods permitted by law during the past forty years. A period less than five years will be of relatively slight value, for the reason that the lobsters lay eggs only once in two years, and require four to seven years to reach sexual maturity. Further, unless the close-season law carried with it the *prohibition* of the *possession* of all lobsters, *wherever taken*, it would be difficult and expensive to enforce the law, even if not entirely impossible, since in some sections the best lobster fishing is beyond the three-mile limit, and fishing in this region would work even greater havoc.

The results of this close season would be quickly dissipated unless a new law is enacted which is based upon correct principles both of law of man and law of nature. Such a law must (1) be capable of ready and economical enforcement; (2) be in the special interest of no class, but give equal opportunities to fishermen, capitalists and the public; (3) it must not bear heavily on vested interests; (4) from the biological point of

view it must guarantee the protection of the adult, in order to prevent undue curtailment of the number of eggs and young produced. We suggest the following as a tentative draft, which appears to embody these features:—

AN ACT REGULATING THE TAKING OF LOBSTERS.

SECTION 1. It shall be illegal to take or kill any lobster or to have in possession any lobster taken or killed in Massachusetts, otherwise than by a trap or pot the entrance of which does not exceed three and one-quarter inches in any diameter, or in a trap or pot of which the slats are less than one and one-half inches apart, or in a trap or pot which is not plainly marked with a buoy and a number corresponding with the identification number assigned to the owner as hereinafter provided.

SECTION 2. Before any person shall engage in the taking or killing of lobsters he shall make application to the commissioners on fisheries and game, who shall without cost assign to such applicant an identification number, which shall be placed upon every boat, trap, pot, buoy, crate or car used in taking or transporting lobsters. The commissioners on fisheries and game shall so far as practicable protect traps, pots and buoys numbered as aforesaid and the lobsters contained therein. No traps or pots shall be used for the taking of lobsters until they have been inspected and officially marked by an agent of said commissioners duly authorized thereto; and all pots, traps, crates or cars shall be equipped with painted buoys or floats not less than twelve inches long, so attached to said pots or traps as to float at the surface of the water and to mark the location of such pots, traps, crates or cars. The identification number hereinbefore referred to shall be painted in a conspicuous color and in block letters not less than two inches long, with lines not less than one-half inch in width, on both the port and starboard bows of all boats used by any person in the taking and killing of lobsters, and such numbers shall not be covered or removed while such boat or boats are engaged in the taking or transporting of lobsters.

SECTION 3. No trap or pot which does not conform to the above specifications shall be used for the taking or transportation of lobsters, and the possession within the Commonwealth of traps or pots which do not conform to such specifications, or the placing of such pots in or near regions inhabited by lobsters, shall be prima facie evidence of violation of the provisions of this statute.

SECTION 4. Any pots or traps not conforming to these requirements may be forthwith destroyed by any officer qualified to serve criminal process, and in addition the owner, maker or possessor shall be liable to a fine of five dollars for each trap or pot not conforming to these requirements, and for a second offence a fine of ten dollars and imprisonment for not more than six months.

SECTION 5. It shall be unlawful to take, kill, buy, sell, have in possession or otherwise dispose of lobsters, which are less than nine inches or more than eleven inches long, taken on the shores or in the waters of Massachusetts, or to use lobsters for any other purpose than as food for man.

SECTION 6. Section eighty-eight, chapter ninety-one of the Revised Laws, is hereby repealed.

SECTION 7. This act shall take effect upon the first day of January in the year nineteen hundred and nine.

The following is taken from the report of the Massachusetts Commissioners on Fisheries and Game for 1906 (pp. 103-111):—

It is important, in a case like the present, to give greater attention to the objections to such a law than to the advantages. These objections appear to be at least five.

First of all, it is not uniform legislation throughout the lobster-producing States, and there is a possibility of working hardship to other States. For example, undoubtedly from Maine there would be a continued tendency to divert the 9-inch lobsters to the Boston market; and Maine would be in the same position with reference to Massachusetts and the States south as was Massachusetts in reference to the 9-inch laws in force in New York and Rhode Island. Should Massachusetts pass the suggested law, protecting the adults and permitting the sale only of those lobsters between 9 and 11 inches, the other States and Provinces would probably find it to their advantage to follow with similar laws.

Secondly, the law is on its face more difficult to enforce, because two measurements, the 9-inch as the lower limit and the 11-inch as the upper limit, are necessary. The difficulty of dealing with the upper limit can, however, be remedied by the use of a pot with a legalized ring (of such inside measurements as would prevent the entrance of lobsters above 11 inches), and an inspection and registration of the pot, instead of the inspection of the lobsters. According to our observations, the catches made by pots with various-sized rings indicate that, in a total of 534 caught in these pots, a smaller number of lobsters above 11 inches are caught by the pots with the smaller rings; and that the average length of all the lobsters entering the pots having a ring 3 inches "inside in the clear" was 9.9 inches, in a $3\frac{1}{4}$ -inch ring 10.4 inches.

These figures show merely that the smaller rings permit the catching of the smaller lobsters, and in general prevent the entrance of the larger lobsters which have reached the breeding size. A $3\frac{1}{4}$ -inch ring will permit the entrance of lobsters even as large as 11 or 12 inches, but the average size is $10\frac{1}{2}$ inches; while the average size of all caught

by the $4\frac{1}{2}$ -inch ring was 12 inches, including some as large as 15 inches and many above 12 inches in length.

The law should provide for the size of the entrance ring. There should be a space of at least $1\frac{1}{2}$ inches between the slats. The law should provide for the official inspection and sealing of the traps, and all traps not conforming to these specifications should be liable to confiscation wherever found. Any one setting an illegal pot should be liable to a fine. The law should seek to prevent the destruction of lobsters which are so small as to be below the size for most profitable use. Such a law would do away with many of the uncertainties connected with the measurements now necessary, and with abuses and evasions too frequently connected with a standard so arbitrary as a definite measurement of a living animal.

The third objection is the injuries to vested interests,—to capital invested in the lobster business. It is a fact that such a bill, if it became a law, would reduce the average size of marketable lobsters taken in Massachusetts waters six-tenths of one pound, and more lobsters would have to be handled by the lobster dealers for a given amount of money (in exact figures, 155 lobsters to every 100 lobsters under present conditions).

Undoubtedly, too, the price per lobster paid by the dealers to the fishermen would be on the average correspondingly less than at present; but the price received by the fishermen and others now in the "short" business would be greater, and the cost less to the consumer. On the other hand, the public demand and use a lobster as small as 9 inches; and the use of at least three times as many lobsters as under the present law would, in the opinion of the writer, do less damage to the future supply of lobsters than does the present destruction of lobsters above $10\frac{1}{2}$ inches.

A fourth objection is found in the fact that perhaps in at least two places in Massachusetts the large lobsters predominate in the catch, and therefore the present interests of the fishermen at these places might be injured. But it is not entirely certain that this injury would be actual; and from personal observations we are convinced that there are even at Cape Cod at least six lobsters between 9 and $10\frac{1}{2}$ inches to every one over $10\frac{1}{2}$ inches, while off Monomoy the 9 to 11-inch law would permit capture of about half of the lobsters at present taken. But the total weight of the catch would be considerably diminished.

A fifth and most important query is, Will enough lobsters escape the critical period of 9 to 11 inches and pass into the exempt class, where they can be sure of an extended period of egg-producing usefulness? This is entirely problematical, and there is at present absolutely no knowledge bearing upon the case. It is a fair presumption that enough would so escape. In any event, the lobster would have, under the proposed conditions,—exemption from capture after reaching the

point of 11 inches,—far greater opportunity to lay a larger number of eggs than under existing conditions; since under the present laws not only every lobster above $10\frac{1}{2}$ inches is exposed to capture, but, as a matter of fact, a greater number of those between 9 and $10\frac{1}{2}$ inches or even smaller are captured, in spite of all the machinery of law enforcement which can be brought forward. The fact that lobsters on the average increase 15.6 per cent. at a moult is of importance. Thus, a 9-inch lobster would become $10\frac{1}{2}$ inches in one moult, and a $9\frac{1}{2}$ -inch lobster would become 11 inches, and thus exempt. Many individuals would pass within a few days entirely beyond the legal size for capture; and the actual length of time which a lobster requires to pass through the dangerous period of adult life (*i.e.*, from 9 to 11 inches, the only period when exposed to legal capture by man) may be, after all, relatively brief for any one lobster, practically during not more than two moults, probably not more than four years at the maximum. Yet there should be such a number of individuals as to satisfactorily supply the market.

Our experience with the present laws dates from 1873. Since that time, even with the protection of a certain number of adults by purchase of egg-bearing lobsters and the hatching of eggs by the United States Bureau of Fisheries, and in spite of the fact that the $10\frac{1}{2}$ -inch limit was fixed at a point where the lobster had an opportunity to produce at least one litter of eggs, there has been a gradual decline in the catch of lobsters in Massachusetts from 84 per pot in 1891 to 28 per pot in 1904; and from 1 egg-bearing lobster to every 22 lobsters above $10\frac{1}{2}$ inches in 1890 to 1 egg-bearing lobster to every 52 lobsters above $10\frac{1}{2}$ inches in 1906. The present laws are difficult to enforce; first, the public demand for 9 to 11 inch lobsters is strong; second, it is easy to destroy the evidence that a lobster was below the legal limit of size; third, the law is easily evaded, and therefore tempting; fourth, it is not practicable to properly safeguard the law-abiding fishermen. Honorable men throw overboard the short lobsters from their traps, and see these caught the next day by unscrupulous neighbors.

In the opinion of this commission, the lobster is approaching commercial extinction. In the neighborhood of the great markets, *i.e.*, in the waters of Connecticut, Rhode Island and Massachusetts, the decrease is especially evident; yet the biological conditions and the productive capacity of the race still remain essentially the same as they did when these same waters produced at least ten times the number of lobsters that they do to-day. Under wise laws, these waters might again produce as many lobsters as they did twenty or more years ago; but, in order to produce again the requisite number of lobsters to meet the demand, not only must there be protection for *all* the adults of breeding age, but active measures must be taken for placing the artificial lobster industry upon a commercial basis, when the value of

the number of young lobsters produced will be in dollars and cents greater than the actual cost of production. The trout, shad and oyster industries have reached that stage. The lobster industry at present has not; but the outlook is promising; and appears to lie through the protection of the breeders, supplemented by protection of the just-hatched young up to such a stage as they are able to care for themselves on the bottom of the ocean, either after the methods developed by Bumpus and Mead in Rhode Island, or by the method of specially protected breeding reserves or nurseries for the young; and on this your commission hopes to have something to report next year.

In conclusion, we may say that, for the interests of the Commonwealth and of the lobster, a new law, restricting catching to those lobsters between 9 and 11 inches, and putting a close season upon both males and females above 11 inches, is without doubt a step far in advance. It is not a departure so radical as it appears to the popular mind at first glance. The close-season law has many obvious advantages, and the protection of the adult lobster is already in practical operation to a limited extent. The proposed measure is a combination of "close season" and the "9-inch" laws; and, though essentially a compromise measure, it embodies the advantages of both with the disadvantages of neither.

Finally, such a law as would permit the legal catching and marketing of any lobster between 9 and 11 inches, except those with eggs attached, would readily meet the market conditions in all the States and the Maritime Provinces. It would permit fishing to be carried on at all seasons, for the close season would then be upon only *a part of the lobsters all the year*, instead of upon *all the lobsters for a part of the year*.

During the past four years this modification of the law has been carefully considered, and now numbers among its adherents many persons whose intelligence is unswayed by personal considerations, since they are interested in the lobster neither as fishermen nor dealers, and whose opinion is, therefore, of greatest weight.

This proposed measure has the written endorsement of such eminent investigators in marine biology as:—

Prof. F. H. Herrick, special investigator of the American lobster for the United States Bureau of Fisheries.

Prof. W. K. Brooks of Johns Hopkins University, director of the Chesapeake Zoölogical Laboratory.

Prof. C. O. Whitman of Chicago University, director of the Marine Biological Laboratory at Woods Hole.

Prof. E. L. Mark, director of the Zoölogical Laboratories, Harvard University.

Prof. J. S. Kingsley of Tufts College, director of the Marine Laboratory at Harpswell, Me.

Prof. Sidney I. Smith of Yale University.

Prof. John M. Tyler of Amherst College.

Prof. E. G. Conklin of University of Pennsylvania.

Prof. Jacob Reighard of University of Michigan.

Prof. William Patten of Dartmouth College.

Prof. J. L. Kellogg of Williams College.

Prof. G. A. Drew of University of Maine.

Prof. H. V. Wilson of University of North Carolina.

Prof. A. L. Treadwell of Vassar College.

Prof. A. W. Weyssse of Boston University.

H. E. Baker, Sidney, C. B.

Prof. A. D. Mead, Providence.

Prof. T. H. Morgan, Columbia University.

Prof. Francis H. Herrick of the Western Reserve University recommends a radical change of policy in protecting the young lobster. "The theory of past legislation has been that the young lobster is in greater need of protection than the old one. Hence it was made unlawful to retain (after catching) lobsters below a given limit in size. Some States fixed the dividing line at 10½ inches and others at 9. These standards have been adopted by most of the Canadian provinces, though one or more place it at 8 inches. This regulation is usually supplemented by a second, which prohibits marketing female lobsters that are spawning." Professor Herrick would reverse the first of these rules, and thus make the second unnecessary. One of his reasons for proposing the change is, that "it would protect the female lobster more effectually than existing laws do, for these can be and are often evaded. It is possible for a dishonest fisherman to remove the evidence that he is violating the statutes. Forbid him to have or sell a lobster which is more than 9 or 10 inches long, whether it is spawning or not, and detection and punishment will be easier than they are now."¹

Professor Herrick is the well-known authority on the lobster. His study of the life history and habits of the American lobster while in the employ of the United States Fish Commission will remain classic, and his opinion carries great weight.

SUMMARY.

The Proposed Law combines Close Season and 9-inch Law.—It would combine the best points of a close season (by putting a close season on all lobsters above 11 inches and below 9 inches) and of a straight 9-inch law (by permitting the legal sale of lobsters between 9 and 11 inches, size-limits which include the largest number of lobsters now caught).

Would be more readily and economically enforced.—By forbidding the use of any pot other than a legal, standard pot, with the seal of the

¹ Cf. Science, n. s., Vol. XXIII., No. 591, pp. 650-655, April 27, 1906.

inspector, having an entrance ring not exceeding $3\frac{1}{4}$ inches, the law could be more readily and economically enforced, since no large lobster could enter the pot, and the further possession of large lobsters would be illegal. The lower limit could be controlled by the prohibition of the use of lobsters as bait, or of their possession for any other purpose whatever, except for use in scientific study. The temptation to keep an 8-inch lobster would be less than that involved in the possession of a large lobster. It would give every man in the lobster fisheries an equal chance. The honest man would no longer throw overboard lobsters for the benefit of his less scrupulous neighbor.

Would increase the Number of Eggs produced. — It would immensely increase the number of eggs produced, and therefore the number of young lobsters which would by growth meet the market demand.

Would improve the Quality of Eggs produced. — By perpetually reserving the best specimens of mature age as a breeding stock, the best quality of young would be produced.

Objections. — The chief objections appear to be the difficulty of enforcement, on account of an upper and a lower limit of size (it should be noted that the upper limit can be cared for by an entrance ring of a specified size upon the pots or traps), and the danger that too many small lobsters would be caught.

But the crux of the whole matter is that the present laws result in a diminished yield of eggs, and to this is to be ascribed the obvious and alarming decline of the lobster in all waters where the effects of these pernicious laws have become evident; and we therefore urge upon you a most careful, judicial and prompt consideration of this important question.

In discussing the question, we strongly urge that the matter be discussed and settled for the benefit of all the people of the State, — consumers, fishermen and dealers alike. It is the person from the interior who, after all, is most interested in the maintenance of the lobster supply, — the fisherman and the dealer are too often interested only to a personal and selfish degree; and this matter should not be left to the consideration only of the representatives of the shore towns, many of whose constituents are actively engaged in the lobster business, and are perhaps too deeply concerned in the pursuit of present gain to give an unbiased opinion upon the methods which the Legislature should carry out in pursuance of the duty and responsibility of the Commonwealth as the trustee and conservator of its natural sources of wealth.

Following are reports of the work done by the U. S. Bureau of Fisheries in Massachusetts for the maintenance of the lobster fishery: —

DEPARTMENT OF COMMERCE AND LABOR,
BUREAU OF FISHERIES, WOODS HOLE, MASS., Jan. 13, 1908.

*Commissioners on Fisheries and Game, Room 158, State House, Boston,
Mass.*

GENTLEMEN:—Herewith I submit a brief report of the lobster work done at this station during the fiscal year 1907.

Between October 18 and December 1, 427 egg-bearing lobsters were received and placed in live cars; 314 of these, or 73.3 per cent., survived the extreme cold of our winter and yielded 3,867,000 eggs.

The collections in the early spring were rather discouraging, but showed a marked increase before the close of the season. The eggs received from the spring collections numbered 19,910,000,—an increase of over 50 per cent. during the year. At the close of the year 12,851,000 fry had been planted. During the season eggs were taken from 1,831 lobsters, 677 of which were furnished by the employees of the Massachusetts commission; the remainder, 1,154, were collected by the employees of this station.

Respectfully,

E. F. LOCKE,
Superintendent.

DEPARTMENT OF COMMERCE AND LABOR,
GLOUCESTER, MASS., Jan. 17, 1908.

*Commissioners on Fisheries and Game, Room 158, State House, Boston,
Mass.*

GENTLEMEN:—I submit herewith a brief report of the lobster work accomplished at the Gloucester, Mass., station during 1907.

During the spring 1,232 egg-bearing lobsters were received, of which 61 were furnished by the Massachusetts commission and 1,171 collected by the employees of the station. The yield of eggs from these amounted to 17,199,000, from which were obtained 16,165,000 fry, which were distributed along the Massachusetts coast.

Though the egg receipts show a falling off of 5,647,000 from the previous season, the results of the hatching were in some respects more satisfactory, as the fry were much stronger than those produced the past three seasons, and there was less loss in the eggs.

Respectfully,

C. G. CORLISS,
Superintendent.

Statement of Fish and Eggs distributed from Gloucester, Mass., Station during 1907.

[Species, Lobster; Age, Fry.]

DATE.	To whom delivered.	Address or Point of Deposit.	Waters stocked.	Number.
1907.				
June 22,	Bureau of Fisheries con- signment.	Gloucester, Mass.,	Massachusetts Bay,	400,000
22,	Bureau of Fisheries con- signment.	Rockport, Mass., .	Ipswich Bay, . .	400,000
24,	Launch "Egret," . .	Nahant, Mass., .	Massachusetts Bay,	300,000
24,	Launch "Egret," . .	Boston, Mass., .	Massachusetts Bay,	500,000
27,	Launch "Egret," . .	Beverly, Mass., .	Massachusetts Bay,	300,000
27,	Launch "Egret," . .	Marblehead, Mass.,	Massachusetts Bay,	400,000
27,	Launch "Egret," . .	Nahant, Mass., .	Massachusetts Bay,	300,000
27,	Launch "Egret," . .	Cohasset, Mass., .	Massachusetts Bay,	500,000
29,	Launch "Egret," . .	Beverly, Mass., .	Massachusetts Bay,	400,000
29,	Launch "Egret," . .	Marblehead, Mass.,	Massachusetts Bay,	400,000
29,	Launch "Egret," . .	Swampscott, Mass.,	Massachusetts Bay,	400,000
29,	Launch "Egret," . .	Nahant, Mass., .	Massachusetts Bay,	400,000
30,	Bureau of Fisheries con- signment.	Rockport, Mass., .	Loblolly Cove, .	1,000,000
July 2,	Launch "Egret," . .	Salem, Mass., .	Massachusetts Bay,	1,500,000
2,	Launch "Egret," . .	Swampscott, Mass.,	Massachusetts Bay,	700,000
2,	Launch "Egret," . .	Boston, Mass., .	Massachusetts Bay,	800,000
5,	Bureau of Fisheries con- signment.	Rockport, Mass., .	Ipswich Bay, . .	2,000,000
6,	Bureau of Fisheries con- signment.	Gloucester, Mass.,	Massachusetts Bay,	1,500,000
8,	Launch "Egret," . .	Marblehead, Mass.,	Massachusetts Bay,	300,000
8,	Launch "Egret," . .	Nahant, Mass., .	Massachusetts Bay,	600,000
8,	Launch "Egret," . .	Boston, Mass., .	Massachusetts Bay,	600,000
13,	Launch "Egret," . .	Manchester, Mass.,	Massachusetts Bay,	320,000
13,	Launch "Egret," . .	Beverly, Mass., .	Massachusetts Bay,	240,000
13,	Launch "Egret," . .	Boston, Mass., .	Massachusetts Bay,	480,000
15,	Bureau of Fisheries con- signment.	Gloucester, Mass.,	Massachusetts Bay,	600,000
17,	Bureau of Fisheries con- signment.	Manchester, Mass.,	Massachusetts Bay,	600,000
22,	Bureau of Fisheries con- signment.	Manchester, Mass.,	Massachusetts Bay,	150,000
24,	Bureau of Fisheries con- signment.	Gloucester, Mass.,	Massachusetts Bay,	50,000
26,	Bureau of Fisheries con- signment.	Gloucester, Mass.,	Massachusetts Bay,	25,000
	Total, . . . . .	. . . . .	. . . . .	16,165,000

REPORT ON THE SHELLFISHERIES OF MASSACHUSETTS.

DR. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game,
Boston, Mass.*

DEAR SIR:—I beg to report the following outline of the investigations conducted by the commission upon the shellfisheries of Massachusetts.

The three years of scientific investigation upon the edible shellfish of Massachusetts, as defined by the Legislature of 1905, in resolves 49, 73, 78 and 93, have been completed, and the results of this investigation are now on file at the office of the Commissioners on Fisheries and Game. The investigations of the past three years considered as a whole have been successful, in spite of the many failures which must accompany any work of an experimental nature. The entire life history of the scallop has been traced from birth to death, and suitable legal protection, based on that knowledge, has been given the scallop fishery. Practical cultural methods for both the clam and the quahaug have been devised and experimentally demonstrated by numerous test beds planted on barren or non-productive areas.

A report, consisting of the results of the three years' experiments, the methods of investigation, the application of cultural methods and the life histories of the edible shellfish, is now ready for publication. Although it has been impossible to obtain all the desired information in three years, and many important questions have not yet been satisfactorily answered, there is, nevertheless, sufficient material at hand to justify the publication of a report upon these shellfish.

In order to realize the full benefit of the investigations of the past three years it is necessary that the report when published should have a wide distribution, especially among the fishermen, shellfish dealers and all those directly and indirectly interested in the welfare of the shellfisheries, and who may wish to know definitely what results have been obtained through the investigations of the Commission on Fisheries and Game. The only way to satisfactorily meet this demand is to have an edition sufficient to furnish at least every fisherman and many consumers with a published account of the life, habits and methods of culture of these food mollusks. In order to print and distribute the required number of copies, it is earnestly desired that a special appropriation be made.

Although a start has been made in the right way by the investigations of the past three years, there still remains much to be done to complete our biological knowledge concerning these mollusks. The work of the past few years has been essentially preliminary to further work,—the establishment of a basis upon which to carry on work of *practical* benefit to the shellfisheries. Many people have misunderstood the position taken by the commission, and have expected that a practical work

of restocking the barren areas could at once be carried out. In the first place, the appropriations were of an amount which would have made hardly an impression upon the shellfish production; secondly, it would have been a waste of time and money to go blindly into the work without any knowledge about the subject; and finally, as a definite policy it appears to be a proper function of the State to ascertain and demonstrate what methods are most suited for giving practical results, rather than to directly undertake the actual work of restocking depleted areas at public expense. It would be equally reasonable for the farmers to demand that the State plant corn and potato fields at public expense. But it is eminently proper that the State should ascertain and demonstrate methods, and educate the public in the application of these methods. The chairman of the commission therefore ordered the work of the first three years to be confined to a preliminary investigation of the life and habits of these shellfish, which would furnish sufficient knowledge for the more practical work of later years.

The commission now possesses a scientific knowledge of these shellfish and their methods of cultivation, which can be put to the practical benefit of these industries. Larger appropriations than those of the past three years are needed to pursue practical as well as experimental work. Appropriations should be made for shellfish in general, and not be confined to any particular mollusk. This would permit the commission to center its efforts where there was the greatest need, and each shellfish could be attended to in its season. Also, investigations could be made on the minor economic mollusks, such as the "winkel," sea clam, mussel, razor clam, etc., which are of value in certain localities, and have been totally disregarded.

The work of 1907 has been carried out on the same lines as the investigations of the previous year, and in part has been a direct continuation of the work of 1906.

The commission furnished me with three assistants for the summer: J. R. Stevenson of Williams College and F. C. Lane of Boston University continued the work at Plymouth and Ipswich, and W. G. Vinal of Harvard University assisted at the commission's laboratory at Monomoy Point, Chatham, Mass. The work of all the assistants was faithful and excellent in every respect.

Three distinct lines of work were carried out during the past year: (1) work on the north shore at Plymouth and Ipswich during the summer, by Stevenson and Lane; (2) a survey of the shellfish-producing area of the State, by Lane and Belding in the autumn; (3) work at the laboratory at Monomoy Point during the summer by Vinal and Belding.

The work on the north shore was confined to the soft clam (*Mya arenaria*). J. R. Stevenson conducted investigations upon the following points: (a) effect of soils upon clam growth; (b) food of the clam; (c) general observations, which are considered fully in his re-

port. He was assisted during the first half of the summer by F. C. Lane.

The work of the shellfish survey was conducted in a thorough manner by F. C. Lane during the summer and early fall, and completed by D. L. Belding in the late fall. Personal investigation of the shellfish areas, both productive and non-productive, was made, and important facts relative to the quantities produced, methods employed, labor and capital invested, town regulations and general history, etc., of the shellfisheries, were compiled, and are embodied in the report upon the shellfisheries of Massachusetts.

Work at Monomoy Point, as conducted by Vinal and Belding, consisted of two main parts: (1) the investigation of the embryology and early life history of the clam, quahaug and scallop, applying methods of spat collecting and artificial rearing of the young. Although abundant in 1906, no set of oysters could be obtained at Monomoy Point the past year, thus rendering impossible any work on the young of this mollusk. Although the young of the other three shellfish were studied, the results on the embryology and early life history of the scallop were most successful. (2) Growth experiments, checking up and continuing the observations of 1906, were conducted with all four shellfish. Various methods of artificial culture were applied to clams and quahaugs, and experimentally tested.

While the experiment station at Monomoy Point has been extremely well adapted to the preliminary work of the past three years, it has now outlived its usefulness. Further work, if extensive and practical, demands a broader field and greater opportunities. Besides its limited opportunities, the location of Monomoy Point (on the end of a peninsula, ten miles from the nearest town, Chatham) has many disadvantages for the situation of a laboratory. The lack of transportation facilities renders travelling expensive and wastes valuable time. Tools, working material, provisions, etc., are hard to procure when desired for immediate use, and manual labor can not be hired.

Respectfully submitted,

DAVID L. BELDING,
Biologist.

INLAND FISHERIES.

Trout. — A distinct advance was made last year in the administration of the wild trout fishery when the open season was made uniform throughout the State. From April 15 to August 1 these fish may be taken in any of the public streams, and it is no longer possible for an undue rush of fishermen to overfish the section which has the longer open season. The monetary value alone of the trout caught in Massachusetts is given by the Massachusetts Department of Statistics of Labor

as not less than \$66,000 per annum, not to mention the value of well-stocked trout streams as a stimulus to honest and healthful recreation, and a local as well as a State asset of direct or indirect value to all citizens. The young trout live chiefly in the weedy shallows and spring holes at the head of the streams, where they feed upon the small crustacea and insect larvæ. An important source of food is the larvæ of *Anopheles*, the mosquito which is responsible for the spread of malarial fevers. The crustacea and insect larvæ in turn feed chiefly upon microscopic plants, bacteria, diatoms, desmids, etc., which by their growth utilize the waste nitrates and nitrites washed from the soil. Thus the trout in the last analysis, in addition to furnishing recreation and food for man, destroys enormous numbers of the most malignant type of mosquito, and in a state of nature utilizes the waste natural products of the land.

Though for many generations the trout has been familiar as a source of sport and food, much remains to be learned of its natural history, and of the methods by which it may be fostered and maintained unimpaired in quantity and quality. Fortunately, few fishes are by nature so well adapted for artificial propagation, and under favorable conditions so difficult of utter extermination. The requirements are pure, cool, well-aerated water in reasonable supply, gravelly spawning grounds and protection for the breeders of medium size. The large fish more than three or four years old destroy as food too large a number of smaller trout. While on this account they are of undoubted value in checking the undue increase of the species under natural conditions, the large fish should be most sought because man has introduced other checks much more varied and effective. Some of the most important of these new checks introduced by man, and which are conditions directly prejudicial to the well-being of the trout, are (1) overfishing through destruction of the breeding adults, and fishing in nursery streams, with destruction of enormous numbers of undersized fish, — a wasteful practice and therefore properly illegal. (2) A false criterion of successful fishing, *i.e.*, undue emphasis is placed upon numbers rather than upon size and weight of the fish caught. This leads unthinking men to seek the slaughtering type of fishing rather than a real contest of skill with a veteran trout. (3) Pollution of the streams by sawdust, manufactory

wastes, acids, oils, tarry refuse, sewage, etc. (4) The ill-advised introduction of other species into valuable trout streams, or into waters communicating with such streams. In many instances black bass, pickerel, red perch and other enemies of trout have been introduced into waters suitable for trout. This is not only an economic mistake, but in other countries it is punishable by law. Unfortunately, however, we have not yet been driven to a proper consideration of the necessity of conserving carefully our natural resources. We should, however, lose no time in passing a law which should effectually advertise the fact that knowledge and forethought are necessary in maintaining our inland fisheries, and therefore no fish shall be introduced or planted in any public waters, or in any stream or pond communicating with public waters, without the written authority of the Commissioners on Fisheries and Game.

Of more far-reaching effect, however, are the disastrous results of (5) indiscriminate cutting of woodlands, and of (6) forest fires. There is no question that these two factors have enormously increased the range of difference in the volume of all our streams between the highest and lowest marks. With the loss of the spongy humus of the forest floor the run-off is so rapid that the shallow nurseries at the headwaters of the stream are washed out and stripped of their protecting vegetation, but the trout food and the young trout are prematurely carried down stream by the irresistible rush of waters, and become a prey to the larger trout. The gravelly spawning grounds in the upper reaches of the brooks are washed away and replaced by boulders. In the early summer the flood makes way for a drought. The trout nurseries dry up. If not completely, they become restricted to the deeper pools, where the young fry become unduly exposed to the voracity of their older kindred; or with the advent of winter these diminished streams and pools may be frozen solid, thus completing the destruction. Such is the melancholy history of some of the best trout streams of New England and of the middle States. These small streams are of much value to the State and to their locality as a source of water power for factories, farms and dwellings, in addition to the production of trout, and the entire responsibility for their maintenance must not be placed upon the national or State governments, but private owners or associations must develop

wise precautions by suitably protected forest reservations, where scientific methods will save the streams and the trout, and provide asylums for the useful birds.

While recognizing the fact that there is a wide difference of opinion among men competent to judge as to what constitutes the best measures to pursue for maintaining the trout supply, the most equitable laws to enact and the most efficient methods of propagation, stocking and distribution, we sincerely believe that your commissioners conscientiously seek to deal frankly, intelligently, tactfully and fairly, with due consideration of the economic and biological aspects of the problems which come to them for solution. The general basis upon which rests the problem of maintaining the trout supply was outlined in our previous report, as follows:—

Stocking State Waters with Food Fish.—The practice of maintaining and protecting the fisheries of the public waters at public expense is of long standing, and is firmly established in well-nigh all densely populated States and countries as both expedient and profitable. Two definite methods are in vogue:—

I. The regulation of fishing for the purpose of protecting the adults either (1) during the breeding season, or (2) in cases where the demand exceeds the natural increase: (a) by reducing the number of fish taken during the year; (b) by limiting the catch; (c) by limiting the number of days upon which fish may legally be taken, *i.e.*, a close season; or (d) by prescribing how and by what apparatus fish may or may not be taken.

II. The artificial hatching and rearing of young fish, and subsequent stocking of the water by the liberation of fry just hatched, or, preferably, one or two year old fish.

The purpose for which such laws are instituted is absolutely correct. If the adults of both sexes are not protected, the number of fertile eggs laid is immediately reduced. Then necessarily follows a decrease in the number of young hatched, and a proportionally smaller number of immature fish. Observations indicate that in a natural trout brook, undisturbed by man, an optimum population of all classes of life is established; enough insect larvæ, adult insects, worms, crustacea and small fish of various species are present to furnish food for a rather constant number of young trout. Further, practically enough large adult trout are present to eat at least 90 per cent. of the trout fry before these young reach the breeding age, and to furnish a number of offspring practically just sufficient to furnish food for themselves and similar large fish. Thus a surplus of not more than a pair or two come to maturity out of the hundreds of annual progeny of each pair

of breeding fish, to replace the old trout which pass on through accident or senile decline.

When, however, man appears, and a considerable number of the breeding fish are removed by him, the most important consequence is a sudden diminution in the number of eggs laid and a corresponding diminution in the number of fry hatched; consequently, a relatively larger proportion of young fish which are destined to go as food for the "big fellows." A 2-pound trout, for example, requires a certain weight of animal food per day. He will persistently hunt until this amount is secured and his voracious appetite is satisfied. If, then, only a relatively small number of young trout are present, it is possible that every one of these may thus fall victims, and not alone an actually smaller number but even no surplus fry may remain to grow to become breeding adults. When this occurs the trout fishery in that brook declines, and the waters soon become occupied by less valuable fish; or else the stream remains unproductive, yielding either nothing to man, or at least less than its normal productive capacity. Such is the history and condition of most of the unpolluted waters of Massachusetts, chiefly from a failure to maintain unimpaired the number of breeding adults.

The necessity of meeting these conditions has led to biological studies which prove the following facts of economic importance:—

(1) More trout fry can be secured by artificial impregnation of the egg than are ordinarily hatched under natural conditions.

(2) The trout fry can be reared artificially in immense numbers, with less mortality than in nature.

(3) By an increased quantity of food the rapidity of growth may be accelerated, and by substitution of an artificial food in place of young fish a greater weight of trout may be secured at less expense. Whereas nature feeds calves with whole milk and trout with smaller trout, man secures equal results at less cost by substituting foods of other less valuable materials.

(4) To an age limit not yet very definitely determined, but which is at least at or near the age of sexual maturity (two years in the case of brook trout), more satisfactory economic results may be obtained by continuing the artificial feeding and rearing than by liberating the fry at an earlier stage. The obvious advantage of this method of stocking our waters is found in the fact that the larger the fish are at the time of liberation the smaller is the number that fall a prey to the voracious adults. Hence stocking with fingerlings, *i.e.*, trout one year old, has proved more satisfactory and economical than stocking with fry, *i.e.*, just-hatched fish, or, more exactly, fish which have just begun to feed actively and swim. Similarly, and such is the testimony of the Maine commissioners, it is to be expected that two-year-old fish would yield better results for restocking than would younger fish.

The Number necessary for Stocking.—The question of the proper number to liberate in a stream at the time of stocking demands a con-

sideration of several points: (1) the amount of food, (2) the minimum volume of water in times of drought, and (3) the number of fishermen resorting to those waters. In general, a large number of fish can be reared and transported relatively cheaper than a small number, and the chance of success is manifolded if the number is adequate. In too many cases we are obliged to make plants by liberating the young when the number of fish available is so small that it is probable that all the fry or fingerlings are eaten by larger fish, leaving no surplus to become established as breeders. Often an additional 100, 500 or 1,000 fingerlings in a brook or a pond would satisfy the demands of the larger fish, and leave an adequate surplus. This may cause one to question the practicability of any stocking of the water whatever; but we should note that nature does the work in this very way, producing what appears to be excessive numbers of young, very few of which ever attain maturity. The best modern methods are close to nature's own practices, and in general merely seek to hasten and to strengthen her processes.

Since our State hatcheries were established, great changes have come in the methods and possibilities of trout propagation. Formerly there were no commercial hatcheries; the State hatcheries were almost the only available source of trout fry. Fingerlings were rarely, if ever, used for stocking purposes. When it had been demonstrated that trout could be artificially propagated on a profitable commercial basis, many commercial plants developed. From the fact that such an establishment can sell its surplus adult fish at rarely less than 50 cents per pound, also a considerable proportion of the surplus eggs, fry and fingerlings, and that usually the proprietor or manager does the most important work himself (working sometimes twelve or more hours per day when necessary), or personally supervises unskilled laborers, the actual net cost per thousand fish is considerably less than when done at a State hatchery, where both skilled and unskilled labor must be paid maximum wages, and for eight hours' work.

In spite of this, we believe that the State should maintain its own hatcheries, (1) not alone for the purpose of maintaining its independence of combinations of commercial hatcheries to secure unduly high prices, but (2) particularly for the purpose of advancing our knowledge of *diseases* of both young and old fish, (3) of devising improved methods of handling and feeding such fish of all ages and conditions, (4) of determining the effects upon food fish of sewage and other pollutions and upon the possible sanitary problems related thereto, and (5) of making trials of new species and of developing improved breeds.

We are therefore strongly of the opinion that the State's facilities for producing fish for distribution to the public waters is entirely inadequate; that to properly meet this demand not

less than 5,000,000 trout fry and 250,000 fingerlings and larger fish should be produced annually. Only a small fraction of that quantity could be expected from a United States government hatchery located in this State. The private hatcheries are in many cases unable to meet the regular commercial demands, and therefore should not be depended upon for a public supply. We advise the purchase of a site and the development of hatching and rearing facilities which shall become in all its features a model, not alone for the economical propagation and distribution of food fish, but also adapted for accurate and complete studies of all the problems connected therewith. With increasing population and higher prices for essential nitrogenous foods the questions of securing the best possible yields from the water as well as from the land will become of greater importance.

Though we believe firmly that the brook trout is the fish par excellence for our streams, there is much other public water for which this fish is not adapted. To a limited extent we have distributed in certain of our water and have made observations upon the rainbow (*Salmo irideus*), the European or brown trout (*Trutta fario*) and the land-locked salmon (*Salmo Sebago*). When it was learned that trout fingerlings could not be satisfactorily reared at the Hadley hatchery (compare reports for 1903 and 1904), we considered the propagation of black bass or white perch or the large catfishes. With the loss of the surface water, however, this cannot be undertaken with probability of success, though the value of the hatchery building and the supply of ground water for hatching eggs continues thus far apparently unimpaired.

(6) In purely commercial practice it is found to be more profitable to use the eggs from yearling fish for propagation and market the adult fish during the spring succeeding the first spawning. Such a practice long continued must in time lead to a pronounced deterioration in the stock. To prevent our brooks from becoming stocked with inferior fish (the result of breeding from immature parents), the State, acting above and beyond purely commercial practices, must develop and maintain brood fish of such an age and condition as to guarantee the maintenance of the size and stamina of the fry.

Stocking State Ponds. — In stocking State ponds in accordance with section 19, chapter 91, Revised Laws, as amended by chapter 274, Acts of 1903, and further amended by chapter 306,

Acts of 1907, the writer is of the opinion that satisfactory results are frequently not obtainable for the reason that, as the law is mandatory, insufficient discretion is permitted to the commissioners, so that in many instances they are compelled to stock ponds with trout species where the presence of bass or pickerel is almost certain to preclude success. Thousands of trout fingerlings are thus annually sacrificed, to no practical purpose.

The suit which was entered by the Attorney-General against the town of Hadley for damages to the State fish hatchery at Hadley, through diversion of the waters of the brook, has been settled by the advice of the Attorney-General. The sum of \$350 has been received by the Treasurer of the Commonwealth as compensation for these damages.

As the State becomes more thickly settled, there is an annually increasing number of trout brooks leased or purchased by private individuals or associations from which the public are excluded. The question of securing to the public suitable fishing places for recreation must be taken up and settled in the near future.

So much of the report of the superintendent of the Sutton hatchery as pertains to the hatching and rearing of fish follows: —

The eggs collected this season amounted to 548,000, 26,000 of these being brown trout. Of the brook trout eggs, 100,000 were sent to Winchester hatchery, and the remainder, numbering 442,000, were hatched here, resulting in 390,000 fry, enough to fill the applications consigned to this hatchery and stock the ponds moderately.

The brown trout eggs hatched 24,000 fry. All were reserved for the rearing ponds below the dam, where the quality of the water makes it unsafe to place any other fry. The stock of brown trout has been kept so reduced as to yield not more than 30,000 eggs, enough to stock the ponds that seemed best suited to it. It is, however, apparently so well adapted to the water that flows from the breeding pond, the greater part of which goes to waste, that it seems practicable to use this water in keeping a larger brood stock, and secure annually 100,000 or perhaps 200,000 eggs. The hardness of this species of fish, that makes it possible to rear the fry where others so often fail, is shown both in the brood stock and eggs. The defective and weak breeders so common in the brook trout stock are never found. The conditions most favorable for this trout contrast strongly with the conditions preferred by the brook trout. The spring-fed pools in which the brook trout will grow to the largest size seem so unfavorable for the brown trout that the

best will not equal the smallest brook trout. The brown trout make their best growth in the warm water flowing from the pond, in which it is exceedingly difficult to keep brook trout alive.

Ten thousand landlocked salmon eggs were received from the station of the United States Bureau of Fisheries at Green Lake, Me. They hatched late, nearly a month later than the trout eggs, and as they were doing poorly in the hatchery they were removed to some temporary troughs at the springs. Here they did better, and grew into a good lot of fingerlings, numbering 4,000 at the time of distribution. Fifty thousand rainbow trout eggs were received through the United States Bureau of Fisheries from Manchester, Ia., but having been frozen in transit the loss was heavy, and the vitality of the fry possibly weakened, for they did not thrive in any water. Though suited to widely varying conditions, they failed in the warm pools usually stocked with them, as also in the cooler water usually reserved for brook trout. However, the small number that survived the period of weakness grew into the largest fingerlings ever raised here.

The brook trout fry was of the usual quality, except that it contained more defective and crippled fish, thus requiring much time to remove them. The hatching was late, and some of the fry were hardly old enough to feed when sent out. This condition, however, cannot easily be remedied, as it is caused by the cooling of the water in the too long run through the pipe to the hatchery, though some benefit may be gained by improving the conditions at the springs, where the water is collected in small open ditches of considerable aggregate length. Drain tile is being laid in these ditches, so that the water will be nowhere exposed to frost. This work was undertaken previously, but was given up on account of trouble with quicksand. It is found, however, that by bedding the pipes in coarse gravel, and using this freely to cover them, they can be kept open. If this does not make a change for the better it would be well to set some outside hatching troughs at the springs, on the upper course of the brook, to be used when the weather becomes sufficiently mild, and to hasten the late eggs. The deep trough used at so many of the State and national hatcheries would be safe in any weather, and is equally good at hatching fry or rearing fingerlings.

The fingerlings reared did not equal in size the exceptional lot reared the previous year, but were fully up to the average. The most of the ponds showed an increase in numbers, but this was offset by a large decrease in one pond (usually the best), and by discontinuance of the rearing tubs, as the trout in them were so small and feeble as to appear useless if reared.

For several years the average size of the brood stock has been declining, and while excellent in quality, it was thought best to introduce new stock, to secure the advantage of larger size. Two thousand fingerlings were purchased, and they developed into the best yearlings ever

reared here, showing in their spawning a large increase of eggs per fish over the previous year, and undoubtedly as second-year spawners will very largely increase the egg yield.

The extra work during the year was largely directed to providing additional room for rearing birds. The practical limit of the water supply for rearing fish has been reached; therefore no attempt was made to increase the facilities, beyond improving the ponds to give them better protection. More ponds were covered with netting, as it was found that the herons, barred out of the most accessible ponds, turned their attention, somewhat successfully, to the deeper ones. The second pond, usually stocked with yearlings, and the smaller pond above it were walled with stone, and the dam of the yearling pond, with the runway below, for handling spawning fish, were constructed with concrete.

The benefits of this work were quickly shown by the much larger number of yearlings reared and the ease with which they and the larger trout were handled for spawning. The usual general improvements were made, to a less extent, perhaps, as little additional labor was employed for this. Stumps were blown out, brush cut and some grading done; a road was built to the upper tubs, that fish might be more readily shipped from that place. When the pond was drained to complete the spawning the fish were removed, and the mud which had accumulated for eight years was washed out, through a channel built for that purpose, to the flat below the dwelling, where it partially filled the swampy places.

Respectfully submitted,

ARTHUR MERRILL,
Superintendent.

The total number of fish distributed this year to public waters by this department was 855,000 trout fry, 71,000 trout fingerlings, 20 adult pike perch and 3,000,000 landlocked smelts. In addition to this we are informed that several clubs and individuals purchased and distributed through the activity of the Massachusetts Fish and Game Protective Association 54,000 fingerlings.

As we have previously pointed out, these numbers are entirely inadequate to meet the requirements. The legitimate and insistent demand for an increased number of fish makes it imperative that additional facilities for hatching and rearing trout should be provided by the State.

Many of our streams have, as a result of denudation of the watersheds and the pollution by manufactory wastes, become

uninhabitable for the brook trout. In some of these we have introduced the brown trout (*Trutta fario*). The experience and opinion of the New York commission is similar to our own.

There has been considerable discussion of the policy of planting brown trout in State waters. The attitude of the present commissioner on this subject is unfavorable to the introduction of brown trout into waters which the brook trout now inhabits. He does not consider it desirable to liberate brown trout in such waters because it is a much larger fish, growing far more rapidly than the brook trout, and soon driving away or destroying its smaller relative. It appears to be perfectly proper to stock with brown trout such waters as have become unsuitable, and therefore no longer contain brook trout. There is room in State waters for both species, and each has its own advantages. Public sentiment will never abandon the brook trout, which has long held a high place in the affection of the angler and nature lover.¹

Brown trout (*Trutta fario*) in considerable numbers were taken this year by many fishermen in the Westfield River, as the result of 40,000 brown trout fry introduced there by the commissioners in 1904.

PROTECTION OF USEFUL BIRDS.

Massachusetts for many years has taken an advanced position in its demand for the protection of our useful birds. As a people we have had costly experience with biologic blunders, notably the massacre of small hawks and owls under the stimulus of a bounty; the introduction of the English sparrow, the gypsy and brown-tail moths *et al.*; the slaughter of the heath hen, wild pigeon, woodcock, wood duck *et al.* Shooting has made our shore and marshes in spring no longer a safe haven where, as formerly, the Wilson's snipe, sandpipers and plovers, black duck and Canada geese may nest, undisturbed by the sound of burnt gunpowder. Our territory has been scoured by numbers of quasi-"naturalists" who, during the nesting season, have both killed the breeding birds and taken the nests and eggs. Such birds as only rarely visit or nest within our borders are particularly sought and are pursued with especial keenness, until they are finally bagged and skinned, to be exhibited as proof of the

¹ From the twelfth annual report of New York Forest Fish and Game Commission, transmitted to the Legislature Jan. 2, 1907, p. 120.

collector's knowledge and veracity. Such acts practically nullify the natural conditions which make for extension of the range of various species into regions where the environment may become more favorable. Thus the red-headed woodpecker, the orchard oriole, many warblers and other species which come to us annually in limited numbers might become established if spared by these collectors in their zeal for making "new records" for the State, county or town for dead birds. We might make a more worthy record by pointing to many nests of birds which are now "rare" here, but which, if favorable conditions were provided, might become relatively numerous.

Other of our more valuable birds are either diminishing in numbers or no longer come to us on account of the scarcity of suitable breeding places. Modern methods of building have proved prejudicial to the eave and barn swallows, the chimney swift and the phœbe bird. The necessity of destroying old orchards on account of the San José scale and gypsy moth must in time make it much more difficult for the bluebird, great-crested flycatcher, wrens and screech owl to find suitable nesting sites. Mr. William Brewster, the eminent ornithologist, who has been studying the question, believes that the wood duck has suffered on account of the absence of suitable nesting sites, and has suggested that suitable boxes be provided, especially on islands, where these beautiful ducks may make use of them. It therefore behooves all individuals and associations having the welfare of the community at heart to arouse active and intelligent interest in every community to diminish the number of English sparrows, and to increase the number of suitable building sites available to such birds as nest in cavities or in buildings. In many parts of New England bird clubs have been formed for these purposes, usually restricted, however, to school teachers and children. Such activities are exceedingly valuable, both from a practical and an educational point of view, but the question is of such importance as to be well worthy the attention and activity of sportsmen's associations, farmers' organizations and of public officials.

The Least Tern in Massachusetts. — This State is the natural guardian of one of the three last remaining breeding places of

the beautiful little mackerel gull, the least tern. The remote sandy shores of Martha's Vineyard still are the resort of the pitiable remnant of this bird, which fell victim to the fashion in millinery, and was killed by thousands on the north Atlantic coast. The wings and sometimes the skins, eagerly purchased by the wholesalers of New York, London and Paris, are still being placed on the market, and are imported in considerable quantities, though the law in this State very properly places a penalty for the possession of these birds wherever they may have been taken or killed, or whatever their history. So many of these wings and skins have been disguised by dyeing, dissection and other "manufacturing" that they may be foisted illegally upon an unsuspecting purchaser. The purchasers of feathers and hats cannot be too guarded in their selections.

It is hoped that the few hundred least terns left after the slaughter may yet increase in numbers. There are indications that the Massachusetts colony has, perhaps, gained 30 or 40 birds over the numbers nesting here in 1906. At our request Mr. William Hazen Gates visited the breeding grounds; his observations are given below:—

June 19, 1907. Trip to Katama Bay.—On this trip 37 nests of the least tern were counted, most of which were localized in two colonies. Between these two points the nests were scattered along, nearly in a line, just above the highest tide mark. The two colonies were in open patches of sand, almost entirely free from grass. The nest in no case consisted of anything more than a mere hollow in the sand. The eggs were probably freshly laid, as two weeks previous to this no sign of any nests was found along the beach. The nests contained two eggs each, except in 7 cases, where they contained but one apiece. It is probable that the total number of nests could not have exceeded 50, as none of these terns were found along the east shore up as far as Cape Poge nor to the west as far as Herring Pond.

June 26. Trip to Katama Bay.—On this trip practically the same ground was covered as on the last, made June 19. Only 31 nests were counted, although the ground was gone over quite carefully. With the exception of 3 nests they all contained the normal number of eggs, namely, two; the 3 contained but one egg each.

On this trip 1 nest, containing two eggs, of the common tern, was found in the midst of one of the colonies. Aside from this one instance these two species of terns seem to nest separately; the least

tern preferring the open sand, and the common tern the places somewhat covered with grass, or patches of drifted seaweed.

One nest of the least tern was found at Monomoy Point, near the lighthouse, on June 9, and three other birds were seen. At Wood's Hole, also, on Penzance, 1 nest was found and two other terns seen on July 8. These, combined with the colony of nests on the south beach near Great Pond (in which colony 8 nests were counted on July 5), make the total number of nests actually seen 47. Thus it is probable that the total number of nests on the south shore of Martha's Vineyard did not exceed 60 or 65.

The trip on June 26 was made with special reference to the full-moon tides, which had been running especially high. Although the tide had flowed over the sand bar at the south of Katama Bay at one point, it was not high enough to reach the place where the least terns were nesting, as the lowest nest measured about a foot (perpendicular) above high water.

There was a heavy storm on July 2, accompanied by a southwest wind, and on July 5 a trip was made to the south shore in order to see if it had destroyed any of the tern's nests at Great Pond. It had not, however, done any damage to the nests.

Common Terns. — In the trip made to Katama Bay and Cape Poge on May 29 a colony of common terns was found nesting on the south beach. Eleven nests were counted; of these, 4 contained two eggs each, the rest one. Nine of these nests were well grouped in one place and the other 2 were scattered. By the next trip, June 19, all but 3 of the colony had been destroyed and these 3 were gone by June 26. In both cases the cause was high tide, which overflowed the bank once at least during the full-moon tide, about June 25. It is very likely that this colony of terns was driven to nesting in another place, as on June 19 a colony was found not far distant. In this colony 14 nests were counted; of these, 4 contained three eggs each, 7 two each, and 3 one each. Six of these nests were very well built, consisting of quite a mass of dry beach grass, which had been moulded into a very good nest. This colony remained undisturbed up to June 26, when they were last visited, although some fishermen had camped in a tent only about two hundreds yards distant.

There was no sign whatever of any one molesting the eggs of either these or the least tern. Although the tracks of the fishermen were seen all along the south beach of Katama Bay, yet there was no evidence that any of the terns' eggs had been taken or disturbed.

Food of Gulls. — The herring gulls rendered efficient service during the late autumn in Saugus River by devouring thousands of the dead herring, which threatened to become a public nuisance. Though the bulk of the food of the larger gulls is floating

organic refuse, observations have been made which indicate that they might become valuable birds on land if they can at length overcome that fear of man, inculcated by generations of remorseless pursuit by gunners for feathers for millinery and the man who shoots not wisely but too well.

Although the usual food of gulls (*Laridæ*) consists of fishes and insects, they feed also upon rodents. During the vole outbreak in Scotland, in 1892, several species of gulls, notably the great black-backed gull (*Larus marinus*), fed upon the field mice; and gulls are usually named among the species that feed upon lemmings during their migrations. It is highly probable that the larger American gulls feed upon field mice whenever they find them.¹

The Bird Colonies at Muskeget, Penikese and Weepeckets.—Through the devoted efforts of Geo. H. Mackey, Esq., and other bird lovers the colonies of common and roseate terns and laughing gulls on the Island of Muskeget have become restored in a fair measure, and now show some similarity to the condition previous to the “great slaughter” for millinery purposes. In company with Deputy J. E. Howland the writer inspected the colony again this summer. Large numbers of young birds are annually killed by cats, but in spite of this the number of birds breeding here is increasing.

The colonies of common and roseate terns on Penikese and on the Weepeckets also show a gratifying increase. This is not true, unfortunately, with the birds which attempt to breed on Monomoy. Cats practically complete the work which hunters and fishermen begin, and relatively few birds rear their young successfully, even in the more remote sections of the island, which is by nature well adapted to serve as a breeding ground for many species of birds.

Wild Swans in Massachusetts.—All true sportsmen and bird lovers cannot fail to deplore the killing of three wild swans on Nantucket last winter. While doubtless these hunters were within the law and their legal privileges, the fact that these birds, formerly numerous in this State, have been pursued so relentlessly that during the past twenty years but five have been

¹ From Bulletin No. 31, Biological Survey, United States Department of Agriculture, An Economic Study of Field Mice, by David E. Lantz, issued Oct. 28, 1907, p. 53.

taken on this coast, should be sufficient to stay the hand of any reasonable person. An editorial in the Boston "Transcript" well reflects the best type of public sentiment:—

It would seem as if our game laws were comprehensive enough to protect any representative of wild life that it was for the public benefit to have protected; still there are some weak spots in them. To harbor or protect an English sparrow is a misdemeanor but wood ducks, upland plover, all species of herons, mourning doves and wild pigeons are protected by law at all times of the year, and a great many other varieties at stated times. The wild swans do not seem to have been mentioned in the class over which the ægis of the law's protection is placed, and that accounts for the slaughter of three of these birds by some pot hunters in Nantucket the other day. The local newspaper report of this exploit said: "Very few swans have been shot on the New England coast in recent years, good authority stating that but five have been previously taken in the last twenty years." And the hospitality which these beautiful creatures receive when revisiting the homes of their ancestors is to be filled with bird shot. The swan is as much a creature of romance as the deer, and as deserving of protection. Whether the pot hunters in question were violating the law of the State we do not know, but they were disgracing themselves and their community in thus doing their best, or worst, to drive toward extinction one of the most beautiful and noble species of bird life in all the world's history. The south shore and the cape furnish the natural habitat for these graceful creatures of classic fame, and only the stupid craze for slaughter or the man with a gun prevents them from recolonizing their old haunts and coming to their own again.

Birds killed on the Island of Nantucket from April 1 to Dec. 31, 1907.¹

Black duck,	571
Brant,	263
Wild geese,	119
Golden plover,	112
Beetle heads, red breasts and other species of plover,	1,025

2,094

Bird Sanctuaries. — There has been a healthy growth in the idea of setting apart suitable extensive areas where birds may nest and rear their young in comparative safety. These bird reservations, or "bird sanctuaries," promise to open a most feasible method for increasing bird life, and are being estab-

¹ From reports of Capt. Wm. C. Dunham.

lished in many sections of North America by the co-operation of local and national organizations, notably the National Audubon Society, and State and national governments. This idea is in its inception totally distinct from the ordinary "game preserve," where the owners or lessees exercise complete control over the shooting, and to a greater or less extent thereby acquire special privileges and convert to their own use game which is a public asset. It is a question worthy of consideration whether such special privileges as the private acquisition of public property, viz., the killing and reducing to private possession of game birds or mammals upon land from which the public is excluded, should not be called upon to pay a special tax for this privilege. In the other sort of bird reservation no birds are to be killed, either by the owner or by trespassers. A writer in the Philadelphia "Record" says:—

The statisticians who foot up the loss to the country resulting from the killing of insect-destroying birds, and from our further neglect to intelligently protect and foster these winged scavengers of the air, put the gross sum at \$800,000,000 per year. We do not know upon what facts or what basis of computation this enormous total is reached; but if it is one-tenth part true it is a startling showing. The proposition of the federal government to set aside bird reservations and breeding grounds where our feathered friends might be protected in life, liberty and the pursuit of happiness seems to rest upon sound economical grounds. It is a measure of safety for ourselves as well as for the birds.

A writer in the New York "Sun" says:—

The protection of birds in England has reached such a stage that they have become a nuisance, and now it is not unlikely that a systematic war will be waged upon them. The complaint is not of the game birds, which pay in sport and in the market; it is the little feathered creatures that are bothering the farmers and gardeners.

Of course the [English] sparrows are the worst. They have grown to millions in the southern part of England, and the Kentish farmers have had to organize battues to reduce their numbers, as they were devouring seed and grain and destroying fruit to a ruinous extent. Tens of thousands have been shot or caught with bird lime.

The other birds mentioned as destructive to agriculture are bullfinches, starlings, crows and pigeons. Such statements may

tend to a confusion of facts, and tempt the average mind to question the wisdom of protective measures in Massachusetts; but a brief examination of the facts discloses the true situation.

The English sparrow and the starling in the United States have already begun to duplicate the damages above referred to, not alone directly by destroying garden crops, such as early lettuce, radish, beets, etc., and taking tribute of rye, barley and other grains, seeds, etc., but more insidiously by replacing the more valuable native birds, such as the vireo, swallows, martins, cuckoos, orioles and other species which feed exclusively on insects. While it is true that the English sparrow when at its best takes insects to an extent of about 50 per cent. of its food, a very considerable economic loss arises from the fact that the sparrow has replaced species which feed exclusively on insects, and which can by no chance damage property in any degree.

The pigeons referred to are not like our Carolina doves, but are directly comparable to the ownerless pigeons of our city streets, which have descended from escaped tame birds. By some fortunate chance we have thus far escaped the bullfinch, and if Congress properly recognizes the great value and notable efficiency of the work of the United States Biological Survey, the chances of the introduction of injurious birds and mammals in the future will be minimized.

The Use of Birds as Millinery. — It is of interest to note, in connection with the destruction of birds for millinery purposes, that even in darkest Africa steps are being taken to check the killing of birds for the plumage. There has been a gradual development of public sentiment against that feminine fashion of adornment which develops a practice which is ruinous to the country where the birds are killed, and pernicious when the birds are used as ornaments. Of special importance is the fact that the French government is taking measures to preserve the birds which have been an important asset of the western Soudan, on the upper Niger River, south of the Sahara. Dr. G. De-course, to whom the French government entrusted the investigation of this question in that land "where in days gone by the Mohammedan natives would have killed any white man on sight, though they collected feathers to adorn the costumes of the women of the white race," reports that the hunting of the white

heron (whence come the “aigrettes”) should be entirely prohibited for two years, and that to increase the supply, reservations be established, within which natives shall never be permitted to hunt this bird. He further recommends that small French military posts be established throughout the regions to enforce this law.

Happily for the birds, and thus for mankind, most of the feathers now used for millinery purposes are “made,” *i.e.*, are natural feathers, chiefly from domesticated and game birds, rearranged and gummed upon forms by hand, one feather at a time. The gayest colored plumage, the startling and bizarre effects, as well as the extremely artistic creations, are the result of a combination of dyeing and professional feather working. A prominent feather worker in London said: “We have agents all over the world, who buy up poultry and game feathers and send them to the great centers (Paris, Vienna, London and New York), where they are distributed for manufacture.” But “while ladies demand exotic plumages the manufacturers must supply it. It is impossible to imitate the natural beauties of the osprey (*i.e.*, aigrette) or the bird of paradise, or of any of the exquisite little birds that come from purely tropical climates. Birds, however, are not fashionable this year, but a stock must always be kept in hand.” Many unprincipled dealers are selling heron feathers (not only “aigrettes” or “ospreys” but also other feathers from this family) under the claim that they are “manufactured,” thus conveying the impression that they are purely artificial. The process of “manufacture” consists in cutting the skins and the *real* feathers into possible and profitable lengths, dyeing the soiled feathers, and binding them into various combinations and shapes. The parts of such composite birds are usually not difficult of identification, and milliners and others should be on their guard lest they be imposed upon by specious tradespeople, who, by selling such goods under false pretences, may bring the wearer or possessor into the cognizance of the police court.

Shore Birds.—Many sportsmen have rejoiced in the fact that during the spring and fall migrations of this year shore birds, notably Hudsonian curlew, “beetleheads,” “yellow legs” and others have been found in unusual numbers, “more than

for twenty years," etc. The majority of persons, however, fail to take into consideration the fact that such local abundance does not necessarily indicate an increase in the total number of such birds throughout the entire range of the species. It is much more probable that on account of the unusual meteorological conditions, storms, heat and cold, the migrating birds in greater numbers were compelled to stop within our borders. We are strongly of the opinion that the rapid decrease of the migratory game birds, such as ducks, shore, marsh and beach birds, will continue at even accelerated speed until adequate provision is made for safe and attractive breeding grounds through a much wider range of territory than is at present available for the birds. For example, Canada geese, several species of ducks, plover, rails and shore birds formerly nested on our seacoast and shores of our inland waters, in our marshes, or even in the States farther south. Though summer cottages and agricultural operations have in many places greatly altered the natural conditions, there will long remain many localities in this State favorable for breeding an annual crop of ducks and shore birds. To secure such a desirable addition to our bird population, it is first of all necessary that the birds, during the spring migration, should while in our territory be free from the noise of the bombardment which has followed them on their journey southward. With the cessation of this noise comes the feeling of security, and the number of birds remaining to breed within our borders will tend to increase annually. We have long been of the opinion that all shooting, whether on the seashore or inland, should cease not later than December 31 of each year, and begin not earlier than September 1 or October 1 for ducks. In our opinion such cessation of spring shooting is the prime essential for increasing or even maintaining the stock of native birds.

Upland Plover (Bartramian Sandpiper). — The only upland plover we have seen this year were 48 dozen in cold storage. The relentless pursuit of this bird in the neighborhood of its breeding grounds, as well as during its migration, has brought it to the verge of extinction. During several visits on Martha's Vineyard the writer has been unable to see a single individual of this species, and on but one occasion was their call note heard. Deputy I. O. Converse reports that a careful search over their

former breeding grounds in Westminster, Ashburnham and Ashby failed to discover a single plover. The farmers in that section appear to be unanimously of the opinion that they "have not seen a plover for two years," either breeding or migrating. This fact is especially to be deplored, for this bird is an extremely valuable destroyer of insect pests. About 150 "flight birds" were reported from the neighborhood of Newburyport in August. The commissioners would welcome reports as to the presence or absence of this bird in the sections where it formerly was frequently seen.

The Value of Herons. — Of our herons, the American bittern (*Botaurus lentiginosus*) is probably the best known destroyer of meadow mice. This bird is well known in Massachusetts as the "stake driver," making its home in moist meadows, bogs and swamps. Baird, Brewer and Ridgway say of it: "It does not move about much by day, although it is not strictly nocturnal, but is sometimes seen flying low over the marshes in pursuit of short-tailed or meadow mice, which are frequently taken whole from its stomach."¹ Records of the Biological Survey contain a number of instances in which meadow mice were found in stomachs of this species.

Among other *Herodiones* that feed upon meadow mice are the least bittern (*Ardetta exilis*), wood ibis (*Tantalus loculator*), great blue heron (*Ardea herodias*), American egret (*Herodias egretta*), snowy heron (*Egretta candidissima*), and the black-crowned night heron (*Nycticorax nycticorax naevius*). While frogs, fish and fresh-water crustaceans form the major portion of their food, they feed also upon mice, shrews and other small mammals. As a group they undoubtedly effect a reduction in the numbers of meadow mice in America.²

Hawks and Owls. — The new law, chapter 250, Acts of 1907, protecting certain hawks and owls, will make for good in at least two ways: (1) the birds which are most distinctly valuable to the agricultural interests of the State will be directly protected, and (2) the fact that these birds have been popularly misjudged will be forcibly advertised.

¹ The Water Birds of North America, vol. I, p., 70, 1884.

² From Bulletin No. 31, Biological Survey, United States Department of Agriculture, An Economic Study of Field Mice, by David E. Lantz, issued Oct. 28, 1907, p. 52.

Few farmers and sportsmen realize that the majority of the hawks and owls are beyond question beneficial to the community, and therefore worthy of the most careful protection rather than such incessant persecution as has been their lot in the past.

The farmer can scarcely have more valuable dumb "help" on his property than one or more pairs of screech owls (*Scops asio*), popularly known as "small cat owls," either occupying a hollow stub in his orchard or a box placed especially for their occupancy. These birds will destroy an incredible number of insects injurious to garden crops, and wild mice, which girdle the young apple and peach trees. Of the stomachs of this owl examined by Dr. A. K. Fisher 50 grasshoppers were found in one stomach, 18 May beetles ("white grubs," destructive to grass and to strawberry plants) in a second, and 13 cut worms in a third. Of a total of 254 stomachs examined, nearly three-fourths of the food was found to be made up of mice and other injurious mammals and insects, and only about one-seventh of birds (chiefly English sparrows).

Few farmers realize that the damage which is done by the really predatory great horned owl to the poultry keeper who permits his fowls to roost in the trees is vaguely attributed to "an owl," and in the punishment which is consequently meted out, without discrimination, to all owls, the beneficial species have suffered most, for the reason that they are most numerous.

Of the commoner birds of prey which, previous to the enactment of chapter 250, Acts of 1907, were legally subject to destruction, but which are now protected by law, the most important are the two hawks which habitually haunt the fields and meadows, skimming low in search of mice, the marsh hawk and the rough-legged hawk. They are but rarely seen soaring, after the manner of the real "hen hawks." Their habits of flight are sufficiently distinctive to furnish the necessary sign to the hunter that these species are not to be killed. The other species is the osprey, or fish hawk, which from its domestic habits frequently takes up a nesting place in the very dooryard of the friendly farmer, even building its nest upon an old wheel placed for that purpose upon a pole. The large size and white underparts readily distinguish this species, which is of undoubted value to the poultry keeper, since it guards its nest with great vigilance,

and thus drives away the smaller hawks which are liable to acquire an appetite for poultry. The ospreys live entirely on fish, and are by nature so amiable as to permit smaller birds to nest within the interstices of their bulky home. The law, even as amended, permits the shooting of the goshawk, duck hawk, sharp-shinned hawk and Cooper's hawk, all of which are without doubt harmful, in that the larger part of their food is comprised of more valuable birds. The goshawk, the "blue hen hawk," present in Massachusetts *only in the winter*, is very destructive to hares, rabbits, ruffed grouse, heath hen and quail. From an experimental enclosure at the Sutton hatchery it is believed that at least 12 full-grown "white hares" (the northern varying hare) were taken last winter by presumably the same goshawk before the superintendent succeeded in killing the robber. This hawk was unusually numerous in Massachusetts during the winter of 1906-07. The duck hawk is local in distribution and is comparatively rare in Massachusetts. The Cooper's hawk is the most common of the hawks mentioned and therefore the most destructive, and, together with the smaller, sharp-shinned hawk, is responsible for the bad reputation too generally given to all hawks. These birds are difficult to describe, but are sometimes known as "blue darters," from their long and slim contour and the rapidity of their flight in pursuit of their object. In size these hawks are of small or of medium size, with a relatively long tail barred transversely.

It is in a measure unfortunate that protection is denied to the red-tailed and red-shouldered hawks, to the barred owl and especially to the snowy owl, so numerous on the seacoast of Massachusetts and Rhode Island in certain winters. As many as 500 have been reported as killed in New England in a single winter. These birds prey almost exclusively upon mice and rats, and in the far north particularly are, therefore, of great value in checking the increase of these animals, which are so destructive on these great northern breeding grounds to the eggs and young of wild birds. Inasmuch as the northland is now the great nursery of our migratory host of insect-eating warblers, thrushes and other song birds, and of our shore birds, ducks and geese, where practically the only danger may be from wild animals, it is probable that the destruction of such large numbers of birds

so useful as the snowy owl may seriously upset the balance of nature in that region. The snowy owl should be protected as an economic measure.

The short-eared owl (*Asio accipitrinus*) is probably the greatest enemy of field mice. It figures in many historical accounts of vole plagues in England and on the continent. Holinshed's "Chronicle" closes the account of voles in Danesey Hundred, of the county of Essex, in 1581, by saying: "Which vermin by policie of man could not be destroyed, till at the last there flocked together such a number of owles as all the shire was not able to yield, whereby the marsh holders were shortly delivered from the vexation of the said mice." Similar testimony as to the efficiency of owls as destroyers of voles is contained in other chronicles, and in the account of later outbreaks the species is definitely stated to be the short-eared owl.

The chief economic functions of hawks seems to be the destruction of harmful rodents and insects. A majority of the species are decidedly useful, their good qualities far outweighing the bad. A few have no harmful habits, but are wholly beneficial. A smaller number have good and bad traits nearly balanced, or certain species may be beneficial in some localities but harmful in others. Two common species — the Cooper's and sharp-shinned — destroy so many birds and poultry as to far outweigh any good they may do. If legislation against hawks is needed, which is more than doubtful, careful discrimination should be exercised as to the species placed under ban, and corresponding protection should be given those that are of undoubted benefit to the farmer.

Owls. — Owls are pre-eminently enemies of mice. Their eyes are adapted to twilight and nocturnal hunting, and they prey mostly upon animals that are active after sunset. Noiseless of wing and possessed of sharp talons and much strength, they attack small mammals with great success.¹

Forest Fires. — The effect of forest fires upon fish and game are not properly understood by the public at large. Many adult birds are destroyed. Instances are on record where, under exceptional opportunities for observation, birds flying over burning areas have been seen to succumb to the heat and smoke, and to fall into the flames. The damage to nesting sites, the nests and eggs or the newly hatched young is more general, and without doubt may very considerably diminish the avian population which that section under normal conditions should maintain.

¹ From Bulletin 31, Biological Survey, United States Department of Agriculture, An Economic Study of Field Mice, by David E. Lantz, issued Oct. 28, 1907.

The destruction of the spongy, moisture-retaining characteristic of the forest floor increases vastly the rapidity of the "run-off" of water, causing thereby the rushing freshet to destroy the eggs and even the spawning ground of trout. Correspondingly it causes the small streams to dry up early in the summer, and thus destroys the small trout and their nursery.

Under the law passed this year (chapter 299, Acts of 1907), placing upon our deputies certain duties in suppressing forest fires and their causes, our deputies in three instances report work of this character. We believe that our paid deputies will become increasingly efficient in this important duty with the better organization of the forest fire-ward service throughout the State, now being ably undertaken by the State Forester.

We have no classified knowledge of the causes of forest fires in this State, but these would probably differ but slightly from those in New York State.

The causes, as reported by the fire wardens of New York were:—

Railroad locomotives,	20
Tobacco smokers,	14
Fishermen,	14
Hunters,	8
Campers,	6
Supposed incendiaries,	11
Clearing land,	9
Children at play,	4
Berry pickers,	2
Bee hunters,	1
Imbecile,	1
Burning house,	1
Unknown,	51

¹ 142

GAME.

Pheasants.—In 1895 Commissioner Brackett secured from the late Judge Denney of Oregon 12 birds which at that time were called Mongolian pheasants, but which in reality were of the species *Phasianus torquatus*, or ring-necked pheasant, variously called synonymously "Chinese ring-neck" and "Eng-

¹ From the twelfth annual report of New York Forest, Fish and Game Commission, transmitted to the Legislature Jan. 2, 1907, p. 43.

lish ring-neck." Since then the descendants of these birds, on an average of about 400 pheasants per year, have been distributed to applicants, for liberation in all parts of the State.

This pheasant is now established as a game bird, but is the subject of most diverse opinions. There are many thoughtful men who, as a general proposition, very rightly deplore the introduction of foreign birds or other animals, being mindful of the horrible examples furnished by the English sparrow, and the very grave dangers, well-nigh impossible to predict or avoid, which may closely follow either the extermination of a species or the introduction of almost any species of organism into a new habitat. It should be taken into consideration, however, in the case of the pheasant, that its powers of multiplication are relatively limited; that it is exposed to many enemies on account of the fact that it roosts upon the ground rather than in trees; that from its gaminess to the sportsman and its economic value for meat and feathers it will be hunted assiduously. For these reasons it is not likely to increase so enormously in numbers as to escape control. The other most serious question concerns its direct or indirect effect upon our native birds, particularly our ruffed grouse, quail and pinnated grouse. It doubtless may in some degree come in direct competition with all three of these birds, which are, beyond doubt, the three finest terrestrial game birds of America, if not of the world, combining as they do great practical value to agriculture as insect destroyers with habits of life which inspire the sportsman. No effort should be spared to maintain and increase these native species, and their well-being must not be jeopardized by any alien species.

The extent of the keenness of the competition for food and nesting sites, not yet carefully studied in the eastern States, is one of the most important questions awaiting solution at the hands of an accurate and keen observer, who is sufficiently conservative to base his judgment upon a long series of observed facts and experiments.

But of even more importance is the question to what peculiar infectious diseases or injurious parasites is the pheasant subject, and to what extent is there danger of extending such infection to our native birds. This commission has begun to

record observations, and is working in connection with the Bureau of Animal Industry at Washington, and with Dr. E. E. Tyzzer of the Pathological Department of the Harvard Medical School. Simply because some travel-worn quail, brought in mid-winter from a region where these birds were infected with an epidemic, died after having been quarantined in an old pheasant pen, and in post-mortem examinations disclosed certain parasites (*Coccidia*) which are sometimes found in pheasants, and have been reported as well in upwards of twenty other species of common wild and domesticated birds, and are doubtless present in very many other species which have not yet been examined, it is obviously unfair to the pheasant to regard the case as decided against a bird which has many valuable characteristics. The case against the domestic hen and turkey are more conclusive, since these disseminate the internal parasite *Amœba melæagridis*, which is the active agent causing enterohepatitis, which is especially fatal to young quail and ruffed grouse, though both the domestic hen and the pheasant appear to be immune.

There still obtains a wide difference of opinion concerning the extent of the damage to garden crops. We are well within bounds when we say that the total damage done thus far by pheasants is far less than that done by the English sparrow. We find from actual observation that under certain conditions and in the more thickly settled sections pheasants may do considerable damage to early corn, peas, grain and small fruits. To offset this, however, they are expert foragers, wandering over a wide range of territory, and thus destroy enormous numbers of army worms, cut worms, cabbage and currant worms, moths, bugs and beetles of many species of farm pests. Most prominent of these are the caterpillars of the gypsy moths, and the pheasant is worthy of great consideration from the fact that it greedily eats the larvæ at all sizes. This is a service which few of our native birds can render, and is therefore peculiarly valuable.

The chairman and Commissioner Delano have made careful personal observations of the conditions, and have made inquiries of the game commissioners and many farmers and sportsmen of British Columbia, Washington and Oregon, where ring-neck

pheasants have been long naturalized. The preponderance of testimony was very strongly in favor of the pheasant. The decrease of the ruffed grouse was chiefly attributed not to the competition of the pheasants, but to the destruction of the covers by lumbering operations and forest fires, together with over-hunting in certain sections. The pheasants are generally regarded as a good investment in these States, and, in addition, in the States of Illinois, Colorado and Kansas they are now being reared by the thousands for the purpose of stocking the fields and covers.

So much of the report of Arthur Morrill, superintendent, as covers the rearing of pheasants at the Sutton hatchery follows:—

The breeding of pheasants (*Phasianus torquatus*), the so-called "Chinese," or "Ring-neck" or English pheasants, incorrectly called Mongolian, was continued with the same stock, but with improved facilities for rearing the young, and while fully as much trouble was experienced from infertile eggs, weak embryos, weakened and crippled chicks, far better results were obtained in rearing chicks by using brooders and coops that protected them from poultry diseases, and to a large extent from predaceous enemies.

Incubators were used for the first time, and were of great value in finishing the hatch when the hens had brooded the eggs until they were pipped, as all the loss from vicious and careless hens was avoided. Two lots were carried in the incubators through the entire hatching period, with satisfactory results (a little above 50 per cent.). The hatch was as good as the average, and the chicks were equal in vigor to any hatched under hens. This, with the even more satisfactory experience with quail, indicates that incubators can be used much more extensively than has been generally practised by pheasant breeders, but this work will require more careful tests before conclusions can be fixed, for this season's work was based on an assumed difference between the requirements for hatching wild birds' eggs and hatching hens' eggs, the practice being to run the temperature slightly higher, to air and cool the eggs much more, and to provide extra moisture just before the period of hatching. These practices, while seeming to be correct, require to be confirmed by more extensive observations, or possibly varied to secure better results.

Several types of pens were tried; one, very secure and satisfactory, was made 6 by 12 feet, wired all over, with a shed end built of light box boards, that in stormy weather sheltered the birds, together with their dust heap and food. This style was built for either summer or winter use. A larger pen, for summer use only, was made in sections, each side making a section, and when in use was hooked at the corners

and covered with fish netting. This pen was made 12 feet square, and could be moved by two men without taking the birds out. This pen was so satisfactory that if more are to be made they should be of the same style, but larger, as pens 16 feet square would cover nearly twice the ground and could be moved about as easily.

So much ground was reserved on account of possible use by quail and grouse that the area for pheasants was somewhat restricted, and some lots were moved too near ground used the previous year. One lot in particular, placed near ground infected with *Coccidia* suffered much loss from the same parasite which later was found to have infected other lots of older birds, but without causing serious loss. The birds, except the lot mentioned, met with but small loss, and some none at all, while kept in the coops, the age being from three weeks upward. The incidental losses were due to birds escaping, to injuries, mainly feather picking and moulting, to bacterial diseases, chicken cholera, etc. The birds that escaped were mostly taken by hawks, and when all, including the birds raised under hens, were securely penned, the hawks ventured into the open ground around the pens, where two Cooper's hawks and one sharp-shinned hawk were killed. It was estimated that, including the birds they took from hens, the hawks destroyed about 25.

Future work with pheasants to be reasonably successful will require the most vigorous brood stock obtainable and fresh ground each year for rearing the young, with the security that can be obtained only by well-constructed pens. The fixed pen, torn up and rebuilt each year, would probably be less satisfactory here than the one in use, removable as often as desired.

The prospects for another year, based on this year's work, are for a very large increase of birds reared, and it would be advisable to provide ample pen room, more than twice that used this year, for it would be a decided advantage to entirely discontinue the use of hens for rearing, for what is gained through the more vigorous birds they may rear is offset by the greater losses. A small lot of English ring-neck pheasants (*Phasianus torquatus*) were reared for comparison with the hatchery stock, which seems to be smaller in size and more variable in markings than formerly, besides giving the trouble, so often mentioned, of low vitality in their eggs and chicks.

Much work was done in providing additional facilities for rearing birds, movable coops for all sizes of birds were built, the old pens for hatching birds were divided up into additional breeding pens, and trees and brush were cut out, as it was found that too much shade was a serious disadvantage. A new insect house was built in the heavy growth on the north side of the lot, where a more uniform temperature could be secured, the most serious trouble in the past being loss from excessive heat, and consequent irregular supply of maggots. North of the barn much brush and some heavier growth were cut out, to give a

suitable location for brooders, the intention being to give each brooder and coop a raised bottom of fresh earth, to keep the chicks from possibly infected grounds. By using extra coops it will be practicable to allow each brood a coop with sprouting grass or grain.

On the south side of the lot a tract of twelve-year hard-wood growth was thinned out to allow room for moving the coops, enough trees being left to develop into a good grove. This land lies high above the rest of the ground, is clean, and roomy enough for an extensive season's work.

*The Heath Hen.*¹ — During the past two years much interest has been shown to save the last remnant of the eastern pin-nated grouse or heath hen (*Tympanuchus cupido*). It was formerly distributed from Cape Ann to Virginia, and was especially abundant in Massachusetts, Rhode Island, Connecticut, Long Island and New Jersey; but immense numbers of adult birds were destroyed by guns and traps, while the young fell victims to the colonial cat and to forest fires. So abundant was this bird in the dark ages of ornithology, when there was a bounty upon the ruffed grouse and when indiscriminate slaughter of all species prevailed, without thought of the bird's economic value or place and function in nature, that the articles of apprentices often specified that they should not be compelled to eat the meat of this grouse (locally called "heath hen") oftener than twice weekly.

Between 1800 and 1840 the bird had been generally exterminated in Massachusetts. In 1844 Giraud believed it to be extinct on Long Island; as late as 1869 it was still found in New Jersey, and to-day the very last stand of the bird is on the island of Martha's Vineyard.

The eastern bird was first distinguished from the western type by William Brewster, and described by him under the name *Cupidonia cupido* ("Auk," January, 1885, p. 82). In 1890 Mr. Brewster estimated that 120 to 200 birds, inhabiting about 40 square miles, were left over from the previous winter. This number has slowly but surely diminished. Careful daily observations, extending from October, 1906, to May, 1907, showed that the inhabited area has become restricted to about 30 square

¹ A native bird now on the verge of extinction.

miles, and the probable number of individuals to less than 100. By actual count of the flocks very definitely located in various sections of the range, 77 different individuals were accounted for. In May, 1906, a destructive forest fire swept practically the entire breeding grounds, and very few birds were reared that season. The summer of 1907, however, was a favorable one. We know that at least ten broods were successfully reared, and our census this year will probably show that the number of birds has more than doubled.

This grouse (called "hethern" by the natives) has been a well-known and characteristic bird of the island as far back as memory or local tradition extends. Opinions are widely held that from time to time western pinnated grouse or prairie hens have been liberated on the island. Careful inquiries indicate that the facts are as follows: (1) in 1859 Dr. Fisher liberated ruffed grouse and quail on the island, but no western prairie chickens; (2) in 1902 three specimens of the western prairie chicken (*Tympanuchus americanus*), which had survived the sportsmen's show at Boston, were liberated on Martha's Vineyard, but no subsequent indications of their presence are known.

In 1877 foxes and coons were introduced for sport and later liberated from spite, but it is probable that these have now been exterminated, and at present the chief checks to the increase of the heath hen are (1) the forest fires, which in recent years have swept large areas of the breeding grounds almost annually, usually during the nesting period; (2) cats, whether kept or abandoned by the summer visitors, feed upon the young heath hens, terns and other birds; (3) certain species of hawks, notably the goshawk, are known to kill considerable numbers of adult grouse; (4) with the increase of poultry raising on the islands, particularly of the turkey, there is danger of the introduction of enteric diseases, notably "the black head," caused by the internal parasite *Amœba melœagridis*, which is equally fatal to turkeys, ruffed grouse and quail, but which is also spread by domestic fowls.

About 1813 the heath hen disappeared from the district around Springfield, Mass. In 1824 it was reported as no longer common around Boston. Cape Cod was the last stand on the

main land. In 1831 the grouse or heath hen had become so reduced in numbers that a law was passed making a close season from March 1 to September 1. In spite of this the decline continued. Chapter 170, Acts of 1837, made a close season of four years upon this bird, which, by chapter 7, Acts of 1841, was extended for five years. These acts, however, permitted any town to suspend this law in that town for such a period as they deemed expedient. Some towns took advantage of this to secure special privileges for the inhabitants of that town; *e.g.*, Tisbury, on May 6, 1842, "*Voted* that the Law for the Preservation of the Grouse or Heath Hen be so far suspended in the town of Tisbury as to allow the inhabitants of said town to kill, take or sell Grouse or Heath Hens from the first day of December to the tenth day of December inclusive, provided they hunt them without the aid of dogs." The action of a subsequent town meeting indicates that the decline in numbers was rapid. On April 1, 1850, the same town of Tisbury voted to suspend this law so as to permit the hunting (without dogs) of these birds on the "12 and 13 of November next." (Perhaps for the purpose of providing a substitute for the Thanksgiving turkey.) From this period to 1905 there were no systematic attempts to enforce the law. The number of birds killed usually equaled or frequently exceeded the annual increase. The islanders resented the intrusion of non-resident hunters, but many birds were killed by rabbit hunters and by duck hunters crossing the island to the ducking stands on the south shore. Some birds were taken by collectors, and these skins, supplemented by others bearing fraudulent data, were disposed of extensively to museums and natural history stores.

During all this period, however, there was kept alive the feeling of local pride in the heath hen as a peculiar possession of Martha's Vineyard. It has been even stated that sentiments well-nigh voodoo-like in tendency were current on the island, *e.g.*, that a boy must eat heath hen before reaching a certain age. The writer, however, from careful inquiry, is of the opinion that there is no basis for such statements.

Since almost nothing has been recorded of the habits of the heath hen, the following notes, made by the writer on the spot, may be of interest: —

MARTHA'S VINEYARD, May 1, 1906.

At 6 P.M. we arrived at the point where we hoped to find traces of the heath hen. In a cleared field about thirty rods from the road we distinctly saw two large birds. On our nearer approach they squatted close, and their protective coloration was so effective that, although we knew almost exactly the precise location of the birds, we could not distinguish them. We crawled behind the nearest cover, and remained motionless for perhaps ten minutes. At length the long shadows from the descending sun enabled us to distinguish the birds, as they crouched with head close to the ground, among the very scanty vegetation. After another interval of motionless activity on our part, one bird quickly arose and began feeding, apparently without suspicion; soon two more birds arose as if by magic from the ground. Then began a most interesting series of antics. These birds were joined by five others, coming in singly and on foot from the scrub in various directions. The birds came frequently within forty paces of our hiding place, and in one instance alighted on a small oak tree twenty-three paces from our camera. While not near enough for successful photographing, we were well situated for using our field glasses. The birds were all actively feeding in the open field, apparently on grasshoppers and other insects, but nipping red clover leaves very freely. They moved leisurely about. Frequently two birds, sometimes as much as one hundred to one hundred and fifty yards apart, ran directly toward each other, dancing and blowing on the way, with the so-called "neck wings" pointed upward in a V form. On facing each other both squatted, and remained motionless from one to five minutes. We could see none of the nodding and pecking motions of the head so commonly indulged in by domestic fowls when fighting; rarely was there sparring with the bill or striking with the feet or wings. In twelve or fifteen encounters, only three or four times did they strike thus, and only once did we see "feathers fly." Most of the energy seems to be spent in posturing and blowing. Generally, one of the combatants backed slowly away, suddenly stopping if the opponent advanced too rapidly. In all these fighting tactics the similarity of habits with those of the domestic fowl were very marked. From all directions came the peculiar "toot," like distant tug-boats in a fog, all having whistles of the same pitch. This call may be well imitated by blowing gently into the neck of a two-drachm homœopathic vial. Each call extends over a period of two seconds, and is repeated at frequent intervals. It is prefaced by a run of about one yard, with very rapid, mincing steps. The strides, however, are so short that the bird does not advance rapidly. The tail is spread and the wings dropped after the manner of the strutting turkey cock. When the tail is spread, the white under-tail coverts are conspicuous, and remind one forcibly of the "white flag" of the deer and antelope or of our gray rabbit. The head is then depressed and the neck outstretched forward, until it is about parallel with the surface of the ground; the neck tufts are

elevated to a V shape. The bright, orange-colored air-sacs on each side of the neck, directly behind the tufts of feathers, are slowly inflated, until they reach apparently the size of a tennis ball, when they appear like two small, ripe oranges, one protruding from either side of the neck. The duration of the call appears to closely coincide with the period of inflation, and seems to be emitted as the air enters the sac rather than when the air is expelled. The collapse of the sac is sudden. The sound is ventriloquial, and it is very difficult to locate the direction or distance whence it comes, unless the bird can be seen. A second sort of call is much less frequent, and closely resembles a single syllable of the hoot of the barred owl.

Another characteristic antic was a peculiar combination of a short run, a sudden jump of three to five feet into the air, and a rapid uncoördinated flop and scramble in the air, the bird usually alighting within ten or twenty feet of the starting point, but turning so as to face at least at right angles, or even in the opposite direction, from which it started. When in the air it emits a peculiar cacophonous call or cackle, which, when heard at a distance, gives the impression of a hearty burst of laughter. The purpose of these semi-somersault-like manœuvres appeared to be to attract the attention of other birds, possibly even as a challenge, for frequently they seemed to precede the somewhat pacific duels described above. The effect of these sounds, together with the "tooting" calls, in the mists which so often obtain in their habitat before sunrise is weird in the extreme. At 4.15 A.M. on May 2 these sounds were practically continuous, without appreciable interval, apparently from all directions. At 4.45 A.M. six birds could be counted, all in sight at once. They appeared to resort to a particular clear space, of about two acres in extent, where the antics just described were carried on. All the birds, except one, were observed to have the orange-colored air-sacs. These were probably cocks. We saw only one bird which we suspected might be a hen. The other hens were probably nesting, or at least had secured mates, and no longer resorted to the promenading place. As the sun rose high the "tooting" became less frequent; the birds became more restless, often flying to the neighboring low oaks, nesting there until disturbed. The flight reminds one of that characteristic of the carrion crow or black vulture of the south (*Catharista urubu*),—a succession of four to ten strong, rapid wing-beats, followed by a sail of one hundred to two hundred yards on set wings; this is repeated until the bird again alights or passes beyond the range of vision. The line of flight is usually a straight line, twenty to twenty-five feet above the ground. Of our native birds, the manner of flight most resembles our meadowlark.

The bird gives one the impression of admirable adaptation to the open country,— a large, muscular, hardy, vigorous bird, able to withstand snow and sleet, in size equal or even exceeding the ruffed grouse in weight. Inhabiting open fields and pastures, subsisting on in-

sects, leaves, seeds and wild berries, in a country where the absence of foxes and raccoons reduced the numbers of its enemies practically to cats, men, skunks, field mice and rarely some species of hawks, the problem of maintaining and bringing back the bird to its former abundance seems practicable.

Of the total number, twenty-one, which we observed on May 1 and 2, twenty were plainly male; of the sex of one we were uncertain.

The following is a portion of the report of William Hazen Gates of Williamstown, Mass., who worked with the commissioners in studying the habits of the heath hen for the purpose of securing information which might be of service in artificially propagating the species:—

On May 31, while wandering across the plains, three heath hens were started, and each taking wing flew nearly out of sight before alighting. As I watched the birds, a call, resembling to a slight degree that of an ordinary barnyard cock calling to the hens, was heard not far distant. The place was noted as nearly as possible, and then cautiously I made my way there. When the place was reached I looked for birds, but could see none. I then sat down and determined to wait, in order to see if any birds could be heard. The ground was covered with leaves, so the least stir would have been heard. I listened and also looked for signs of anything moving, but none appeared. I sat there for fully twenty minutes, and hearing nothing concluded that either there were no birds or else they had gone as I approached. As I rose a bird flew up within twenty feet of where I had been watching. The bird had been within sight all the while, but probably had crouched in the leaves and remained invisible. It would have been interesting to note how much longer the bird would have stayed in this position without moving. Another bird was started some fifty feet from this one.

On this same day the toots of one or more heath hens were heard between half-past 4 and 5 A.M. The birds are early risers and late bed-goers. Once they were heard to toot at 3.30 A.M., or about an hour before sunrise; and several times their call note was heard as early as this. It is probable, though, that they do not begin to stir quite so early, beginning their breakfasting about sunrise or a little earlier. The middle of the day is generally spent in the shade, or in dusting in the sand in the roads. Late in the afternoon, as the air begins to cool, they take to feeding again, and can be seen in the open fields. They will often feed till nearly an hour after sundown. I do not know whether they roost in the low shrubbery or on the ground at night. Mother birds with young, however, stay on the ground, but it is likely

that this is done only while the young are too small to roost and need the shelter of the mother.

On June 29 a bevy of heath hens was found. The mother bird took flight, cackling, and flew some fifty feet or so. The young scudded in every direction, and were entirely out of sight by the time I reached the spot. I hunted around through the leaves some, but fearing that I might accidentally step on one, did not search very carefully and so did not see any. Two days later what I think must have been the same bevy was again seen, but about half a mile from the place where they were first seen. This time they were in a more or less cleared space, and six of the young were counted. One or two squatted just where they were, and it looked as if one might go right up to them and pick them up. I did not, however, disturb them. These birds were apparently not over a week old.

On July 2 a mother heath hen and four young were seen dusting in a road about 11 A.M. Upon seeing me the mother ran to the bushes and called to the young. As I went by I could hear the mother hen at the side of the road in the bushes. The same day, in the afternoon, a mother hen and one young bird was seen.

On July 7, while walking through the brush near the Cromwell cottage, soon after sundown, I heard some peeping ahead. Getting on my hands and knees I crawled toward the sound. The peeping continued as I approached, so I knew that I had not been perceived. Finally, at a distance of some twenty or twenty-five feet, I saw a mother hen, with wings spread, under the thick foliage of a stunted oak. She was more or less silent, only occasionally uttering a low call, somewhat resembling that of a hen as she calls her chicks at night under her wings. The young, however, peeped quite often as they stole in and out from under the wings of the mother. I think they could not have been much more than a day or two old. Like the chicks of other fowls they could not seem to get settled for the night, but would stray in and out. Then as they sought a place of shelter again they would shove one of their fellows out from under the mother's wing. However, as darkness grew the restlessness ceased, and by the time it was too dark to see the group everything was silent. How many there were in the bevy I could not tell, but it seemed as if there must have been at least six or eight.

According to our observations during the past two years, the birds congregate during the winter in large flocks at points where food is abundant. They readily find grain placed for their benefit, and return to those places with considerable regularity each morning and evening. On two occasions we have been able to count two of the largest flocks in such a way as to be reasonably certain that no bird was counted twice. On

May 2, 1907, we counted a total of 21 birds; on January 11, 1908, an exact count was impossible, but the number was not less than 55 nor more than 60. Since we were reasonably certain that in each case the count was made at the places where the birds resort in greatest numbers, it furnishes some evidence that the birds have increased under the protection which the best public opinion in the island has extended to them. We are of the opinion, however, that the ratio of increase has not been so large as these figures indicate. In common with all the grouse species in the eastern States, the heath hen suffered from inclement weather during the nesting season, so that it is doubtful if the 1907 breeding season resulted in more than doubling the number of birds. Until late in February, the birds remain in large flocks, made up by the congregation of several families, resorting during pleasant weather to the feeding grounds, but during the coldest and stormiest days remaining in sheltered places. With the first appearance of warmer weather, late in February, the booming calls of the mating season begin to be heard, and by the first of March the booming is heard regularly, the flocks break up and the mating season begins. The strutting antics described above begin about April 1 and cease about June 15, being at the height in late April and early May. Egg laying begins soon after May 15, the chicks are hatched in June, and in July, when about the size of quails, are capable of long flights when flushed.

On June 4, a set of nine heath hen's eggs was taken and placed under a bantam hen, selected for this purpose because she appeared to be unusually tractable; but on June 20, when one of the chicks hatched, it was immediately killed by the hen, which attacked it viciously before it was entirely out of the shell. The other heath hen's eggs failed to hatch, and only one contained a well-developed embryo. After destroying the heath hen chick the hen was given some pheasant eggs, hatched them, and reared the chicks with all possible care.

An injured heath hen was received from Martha's Vineyard November 19, but refused to feed, and, though placed in a pen with a tamed ruffed grouse, lived only a week.

The only nest known to the writer was found in oak woods

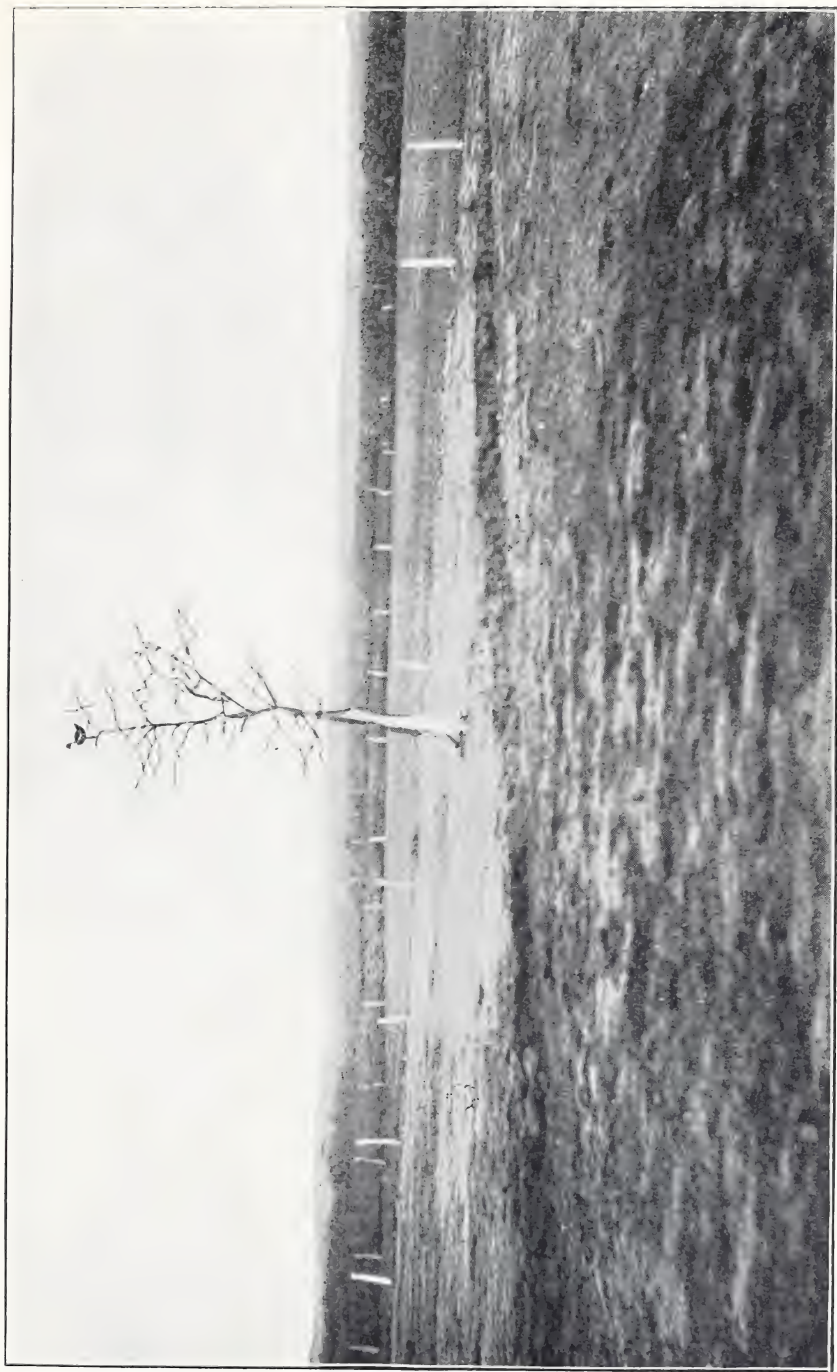
among sprouts at the base of a large stump, and contained either twelve or thirteen eggs about June 10. William Brewster has a set of seven eggs taken July 24, 1885.

In every respect this grouse is adapted for the natural conditions of southern New England. During the summer its food consists largely of insects, clover leaves and blueberries; in the winter acorns, weed seeds and dried fruits. Although inhabiting regions similar to those chosen by the quail, its robustness enables it to withstand the severest weather, and the storms of snow and sleet which decimate the ranks of the quail. The nature and variety of its food is such as to ensure a practically continuous and sufficient forage supply.

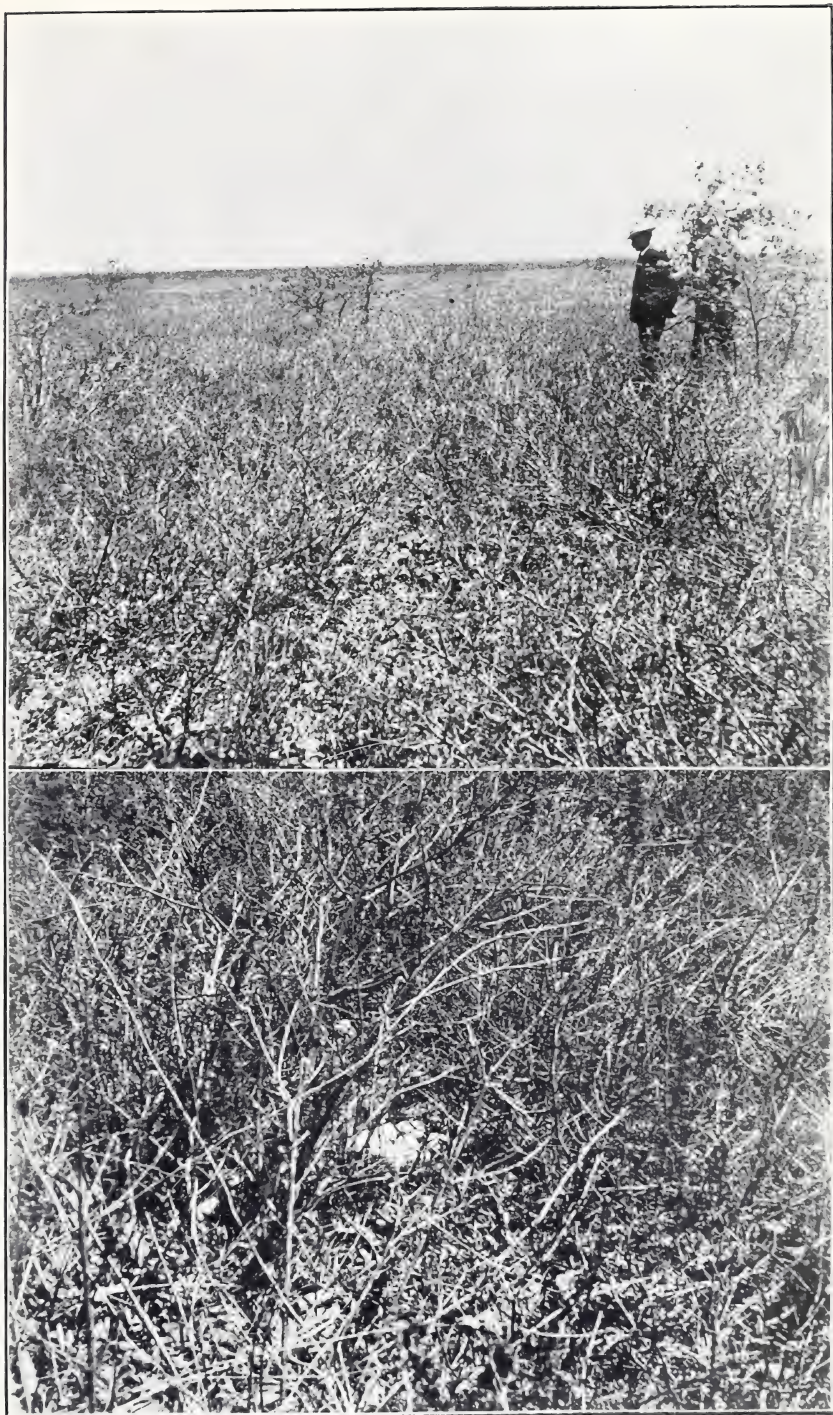
It appears to be most at home in the scrub oak and pitch pine barrens, but if protected from such enemies as the domestic cat, man and forest fires, the bird could be naturalized once more in almost all sections of Massachusetts.

In addition to being a valuable bird upon the farm, it lies well for the dog, has a strong rapid flight and delicious flesh, — qualities which commend themselves to the best type of sportsmen.

The value of the birds as a local asset was early appreciated by many of the best people, but to J. E. Howland is due the credit for initiating the action which promises to prevent for all time the extermination of this bird. Mr. Howland called the attention of the Massachusetts Commissioners on Fisheries and Game to the conditions, and a permanent guardian was located in the midst of the region inhabited by birds, to study their habits and to enforce the law. Amply supported by public opinion, Representative Mayhew introduced a bill, placing under the control and use of the Commissioners on Fisheries and Game such lands as may be donated, leased, purchased or otherwise placed under temporary or permanent control as a refuge and breeding area for the heath hen. Already a considerable amount of money has been pledged by public-spirited individuals and associations for the purpose, and about 1,600 acres placed under special protection. In order that the expense may be minimized, the Legislature authorized the commissioners to take, "for and in the name of the Commonwealth, such unimproved lands upon Martha's Vineyard, not exceeding 1,000 acres, as they may deem



HEATH HEN ON A STUNTED OAK TREE. — This Exposure was made in the Early Morning; the Tree and Bird have been retouched.



COUNTRY INHABITED BY THE HEATH HEN. — In Foreground, Nest of
Heath Hen, with Complement of Nine Eggs.



GROUP OF "PRAIRIE CHICKENS."—Illustrating the Courting Habits, which are similar to those observed and described in Case of the Heath Hen on Martha's Vineyard. By Courtesy of the American Museum of Natural History, New York.



PAIR OF HEATH HENS, NEST, EGGS AND YOUNG. — By Courtesy of the American Museum of Natural History, New York.

necessary for the purpose of making fire-stops for the protection from fire of the feeding and breeding grounds of the pinnated grouse, or of otherwise securing the maintenance and increase of such pinnated grouse, or of any other species of wild birds upon said islands." For work "incidental to these purposes, and for an investigation and reports upon the best methods and probable cost of protecting and increasing the colonies of birds on the island," \$2,000 was appropriated by the last Massachusetts Legislature.

We have carefully investigated the problems involved in the permanent maintenance of the heath hen, and have concluded that: —

1. One or more extensive areas, as reservations or sanctuaries, should be acquired by the Commonwealth, patrolled and maintained. These sanctuaries should include the principal breeding and feeding grounds of the birds. Some of the land should be annually ploughed and sown to clover, rye, corn, wheat, buckwheat, etc.

2. Suitable and sufficient fire-stops should be made and maintained in order to minimize the danger of brush fires, which have in the past proved so disastrous to the birds, vegetation and property.

3. All possible precautions should be taken against the introducing of infectious disease, such as, *e.g.*, Entero-hepatitis, Coccidiosis, "white diarrhœa," chicken cholera, etc., which may be transmitted to the grouse through the agency of domestic hens, turkeys, duck, geese, etc.

4. As soon as the number of birds has increased sufficiently, systematic artificial incubation, feeding and brooding should be undertaken for the purpose of rearing annually an increased number of young birds. By artificial propagation we may expect to increase the number of eggs laid, to lessen the loss resulting from the destruction of nests and eggs by skunks, mice and other enemies, and to reduce the mortality by guarding the young birds against crows, hawks, jays and other enemies.

5. The expense involved would be practically identical with that incidental to ordinary poultry raising, except that on account of the hardiness and vigor of the grouse, the expense of housing the adult birds would be well nigh eliminated.

In addition to practical and most valuable assistance by Wm. Dutcher, Esq., president of the National Audubon Society, John E. Howland, Capt. B. C. Cromwell and many others, contributions for the purchase of land for a reservation and for making fire-stops on Martha's Vineyard have been pledged as follows:—

William Brewster,	\$100
F. S. Pearson,	100
G. B. Clark,	100
John E. Thayer,	100
H. H. Fay,	100
S. M. Weld,	100
Frank E. Peabody,	100
L. D. Baker,	100
Arthur F. Whitin and others,	108
Judge F. C. Lowell,	100
Dr. John C. Phillips,	100
R. C. Robbins,	100
Gardner M. Lane,	100
Dr. B. H. Kidder,	100
Hon. Herbert Parker,	100
Anawan Club,	50
R. L. Agassiz,	50
Hon. A. P. Gardner,	25
Clinton G. Abbott,	2
Edward L. Parker,	25
Mrs. Carroll Dunham,	5
Dr. Gorham Bacon,	100
Harriet E. Freeman,	5
Middlesex Sportman's Association (through Dr. A. H. Tuttle),	200
National Audubon Society,	100
W. P. Wharton,	100
Town of Tisbury (at last annual town meeting),	200
Town of West Tisbury (at last annual town meeting),	50
<hr/>	
\$2,420	

Inasmuch as under these conditions every dollar contributed for the purchase of land adds at least one acre, it is hoped that sufficient funds may be raised to secure extensive tracts as refuges for the heath hen, quail, least tern, upland plover and other birds which still resort to this island.

Contributions may be forwarded to the Commissioners on Fisheries and Game, State House, Boston.

Ruffed Grouse.—In common with all the New England States, New York, Pennsylvania and New Jersey, the ruffed grouse in Massachusetts had a remarkably poor breeding season. There is abundant evidence that the decrease in Massachusetts is no greater than in these other States.

The causes most frequently mentioned are (1) the unusually wet, cold spring and the remarkably dry summer; (2) that the ruffed grouse have been "driven out" or "killed off," either directly by the introduced English or Chinese pheasants, or indirectly by an epidemic due to a parasitic organism with which the pheasant may be infected. While we are confident that no one can be more desirous to know the truth, the whole truth and nothing but the truth concerning the pheasant and its beneficial or baneful influence upon our native birds and agriculture, we are still of an open mind, and would welcome actual evidence of good or bad results attributable directly or indirectly in any degree to the pheasant. That the present scarcity of ruffed grouse is due to the pheasant, as is claimed by many sportsmen and bird lovers, does not appear even plausible on any evidence thus far presented, for the reason that the grouse scarcity is as distinctly pronounced in sections of Maine, New Hampshire, Vermont, Rhode Island, Connecticut, New York and Pennsylvania, where there are few or even no pheasants. A more credible theory would be the possibility that the indiscriminate liberation in this and other States, without quarantine, of quail from points in the southern States which have been found to be foci of the destructive epidemic among the quail, may have introduced epidemic diseases. Of this, however, we have no evidence.

From his own observations in the fields, and from the observations by the deputies, who by special request have endeavored to ascertain facts concerning the breeding and rearing habits of ruffed grouse, and from the evidence obtained by the experiments of Prof. C. F. Hodge at Worcester and of Arthur Merrill at the Sutton hatchery, the writer is inclined to attribute the cause of the scarcity to the fact that from many nests the chicks hatched obviously enfeebled, apparently the result of eggs chilled by the unusually cold weather during the laying period. The majority of these chicks died during the first month, and in

many cases within the first week. Of the 25 grouse hatchings reported to or seen by the writer there were many eggs which failed to hatch, in one case 9 out of 13; none exceeded 6 living young one month old; in four instances there was but 1 surviving. Of these nests which came under our observation three sets of eggs and one parent bird were destroyed by animals, probably either skunks or foxes.

We still continue in the opinion that the annual slaughter of game and insectivorous birds by cats far exceeds that from firearms. We need effective legislation which penalizes the wilful abandonment of cats by summer cottagers. We need, further, a campaign of education which will focus observation upon the suburban and the farm cat, in order that intelligent people may learn that in many cases it may be necessary to limit the cat population for the purpose of increasing the more valuable bird population.

From personal observation the writer is convinced that considerable damage to game birds is wrought by dogs running at large during the close season, or taken at this time to the field for training. In some States this practice is prohibited by law.

The remarkable increase in the number of foxes in this and adjacent States may to some extent be a factor in the decrease of partridge and other game birds. The writer suggests, too, that the increased number of deer may possibly be a factor, since he has observed tame deer search out and eat whole clutches of eggs of semi-domesticated ground-nesting birds, such as turkey and guinea fowl.

So much of Superintendent Arthur Merrill's report as concerns the rearing of ruffed grouse at the Sutton hatchery follows:—

Last year our attempts at rearing ruffed grouse in confinement were unsuccessful, chiefly on account of the infection of the young birds by intestinal parasites, chiefly *Amæba melæagridis*, a protozoan which causes the well-known disease of turkeys known as "black head" (Enterio-hepatitis), and which appears to be transmitted through the agency of hens. This year great care was taken to prevent the young partridge and quail from running upon soil contaminated by hens, and not a single case of this amœbic disease was discovered. Nevertheless, all but 4 of the young ruffed grouse were lost. Though there appeared to be as many partridge nests as usual, a goodly number of birds being

left at the end of the shooting season, only five clutches of wild ruffed grouse eggs were taken to the hatchery. These five clutches numbered 56 eggs; from these 50 birds were hatched. That nearly all the chicks, however, obviously lacked vitality was early noticed. In the case of two entire broods the chicks did not have strength enough to escape from the shells. These chicks, together with some that appeared to be stronger, died within four days after hatching. Of a more promising lot some lived for a week or ten days, but only 4 survived. In case of this lot it was suspected that disease might have been introduced by the agency of infected bedding in the brooder, but pathological examination of the dead birds yielded no trace of disease.

Of the two females reared in confinement last year, one made a nest and laid 7 eggs, but abandoned the nest when the eggs were partially incubated. The other hen laid 14 eggs, and incubated faithfully. In order to ascertain whether another clutch might not be laid, the eggs were taken from the nest. She did not lay a second litter. Of this clutch, laid in captivity, 8 were fertile, but the chicks, like those from the wild nests, were too feeble, and lived but a few days. These eggs were laid and remained in the nest under conditions practically identical with those obtaining among wild birds. It was assumed that the deficient vitality of the birds was due directly to the severe weather of the winter and spring. To determine to what extent the birds in the region about the hatchery were affected, a thorough search with a well-trained dog was made. In a search covering more than twenty-five hours, and extending over at least five square miles of partridge cover, but four broods of young were found, though to our knowledge there had been no nests taken in this region, which usually yields not less than ten nor more than twenty flocks. Of these four broods, one comprised 3, another 4, and another but a single survivor. The fourth flock was a numerous one, of small birds, undoubtedly a second nesting.

Prof. C. F. Hodge who has undertaken the rearing of ruffed grouse on a larger scale and with longer experience, encountered the same difficulties. He reared successfully this year 7 birds. It is a significant fact that all of these were from one litter. All the others had equally favorable conditions as to food, shelter, etc.; but this single brood appeared to have superior stamina.

The care of the adult grouse during the year showed only one feature that may be considered a problem in future breeding operations; this was the disposition of the males to fight. During the winter in a pen of three young birds, one male killed another with which it had grown up, and during the mating season great care had to be exercised lest the male kill the females. His savage rushes caused them such alarm that they suffered no small injury in beating about the coop to escape him. It was not safe to put the male in the coop for mating without close watching, and it was necessary to remove him immediately after mating.

The conduct of the birds in the coops, however small, is in marked contrast to that of any other birds bred here. They appear more at home, moving about their pens leisurely, paying no attention to anything outside, and never show the restless, uneasy manner of quail and pheasants. They eat and relish a larger variety of food than other birds ordinarily take, and there is probably no available article of food that they would not eat if trained to it. However, there appears to be no occasion to supply them with any unusual or any great variety of food; the proper proportion of animal cereal and green foods, the latter including fruits and berries, will keep them in the best of condition.

The male grouse died late in the summer from a germ disease supposed to be from infection of the ground by hens, and when examined was extremely emaciated, and showed an unusual development of the disease, indicating that the adult grouse has more vitality for resisting such disease than the young grouse or adult quail.

CLARK UNIVERSITY, WORCESTER, MASS., NOV. 2, 1907.

Dr. GEORGE W. FIELD, *Chairman, Commission on Fisheries and Game.*

MY DEAR DR. FIELD:—I beg herewith to hand you a brief report on the season's work with the ruffed grouse and quail.

My permits for the year allowed me to take 80 eggs of the ruffed grouse and to keep three pairs of bobwhite (quail) for purposes of propagation.

Grouse eggs were obtained as follows:—

LOCALITY OF NEST.	Number of Eggs.	Number hatched.
Jefferson,	14	14
Charlton,	12	9
Millbury,	12	7
Brookfield, deserted,	8	8
Canada,	8	—

Total, 54 eggs from Massachusetts, and 38 chicks.

As will be seen, the eggs did not hatch as well as in the previous years of the experiment, possibly due to cold weather in May. The eggs were all hatched under Cochin bantam hens, as usual. The chicks are accounted for as follows:—

Fifteen chicks, June 6, left with hen mother, began dropping off after the first two weeks and were all dead by August 15.

Fifteen chicks, June 6, transferred on morning of hatching to brooder; 2 escaped, 1 died, probably as result of accidental injury, 2 died from swallowing objects too large to pass into gizzard (black cricket and large spider), 10 are healthy, well-grown birds at present.

Eight chicks, June 19, transferred to brooder, and all did well until, on sudden change of weather, temperature ran too high and killed them all.

The experiment was conducted this season on my new place, on uncontaminated ground, and I thought it desirable to try once more the simpler method of rearing with the hen. The result is decisive against this method. The fact that the hen carries parasites which are likely to prove fatal to young grouse probably explains why our native species have not long since been domesticated. All former attempts to domesticate them have been made in the poultry yard, and this environment has been fatal to the grouse. The same is now being proved to explain why the turkey, another native American species, cannot be reared on ground contaminated by domestic fowls. This is the fifth year in which the experiment of rearing ruffed grouse with bantam hens has been tried; and although the second year 6 birds were reared out of a clutch of 12, for all the other years fatalities by this method have amounted to 100 per cent. This season is particularly decisive, because the work was done on new ground, under most favorable conditions, with the benefit of past experience, and in clear competition with the brooder method.

Neither my assistant nor myself had experience in handling a brooder, but results give assurance that, barring accidents, practically every ruffed grouse chick hatched may be reared to maturity by this method. If brooders are at hand, by having connected with them adequate yards in which the chicks may run during the warm days the method is neither expensive nor difficult. Hatching, as they do, about the first of June, the chicks require but little heat; and they develop and feather out so fast that it is not necessary to supply any heat for more than about the first two weeks, except during cold storms. After this time they begin roosting in the brush with which their cages are supplied, or, in case of chilly weather, they may be shut up in a dry, warm box at night.

For use the past season we have devised and built a most convenient rearing cage, made by stretching inch-mesh netting over light ash boughs. The cages are 6 by 12 feet on the ground and about 5 feet high. A strip of rubberoid a yard wide is tacked over one end, and this end is also covered with the same material, and a strip 18 inches wide is placed all around the bottom of the cage inside the wire. This arrangement provides protection and a dry place in which to keep food and dusting boxes in stormy weather, and the bottom strip prevents them from bruising their heads on the wire. The cages are so light that one man can easily move them daily on to fresh ground.

In case it should prove desirable to rear native grouse with hens, these might be hatched in incubators and reared on uncontaminated ground. Probably in this way a strain of fowls might be reared which would be safe mothers and brooders. This experiment may be tried

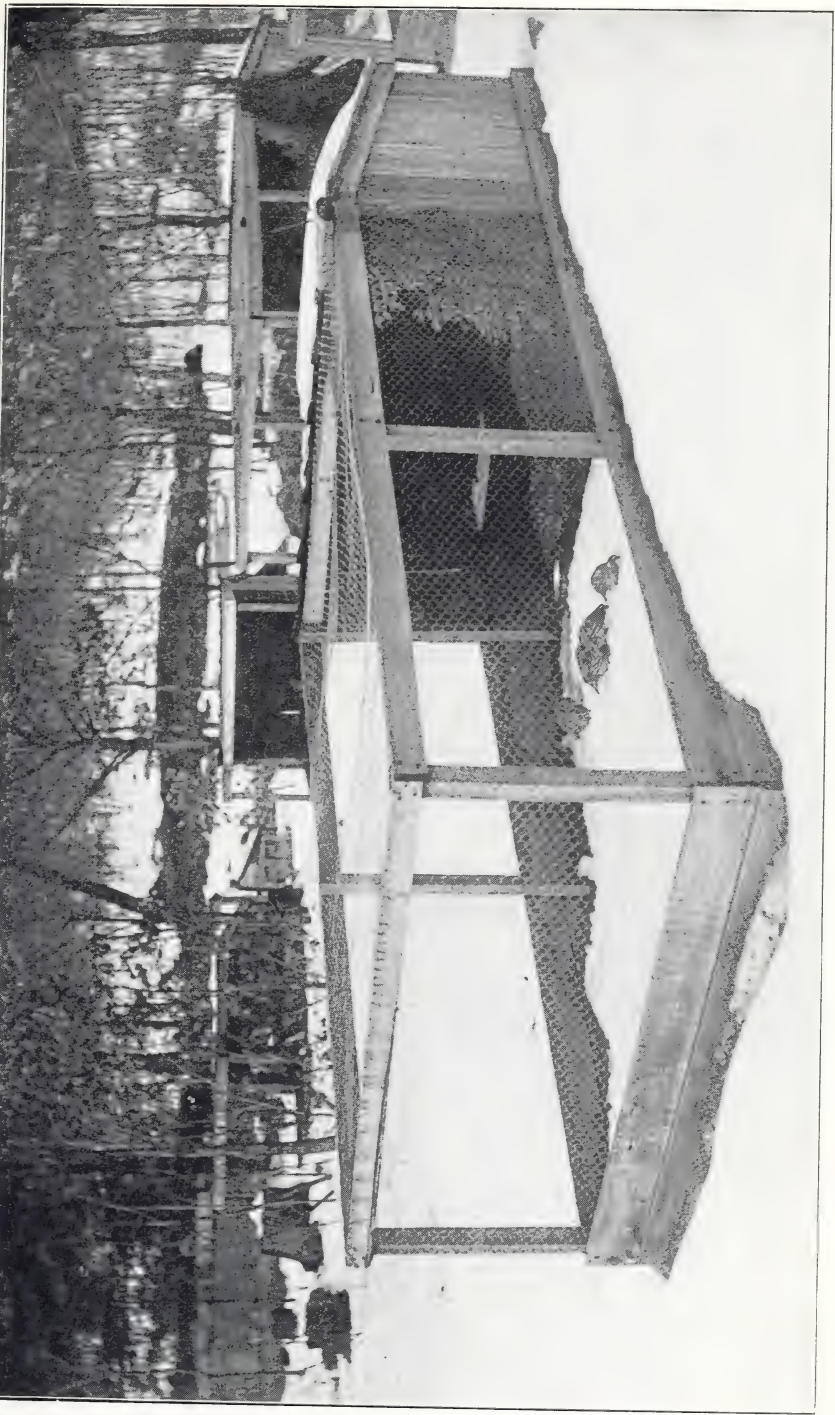
year after next, if we succeed in rearing the uncontaminated stock next season. For the near future, however, I wish especially to perfect methods of rearing, including incubation, artificially.

The bobwhite have proved much easier to handle than the grouse. I had a single pair kept as pets in the house to study. Both were birds of the previous season. They were observed to mate often from May until well into August, and the hen laid 18 eggs in a nest made by the pair in a window cage. Since the birds did not seem inclined to incubate, the eggs were placed under a bantam hen. Six out of the first 13 eggs laid hatched, and the chicks, being left with the hen, all died within ten days. The remaining 5, of which 3 hatched, were incubated under a second hen, along with 11 eggs obtained from the State hatchery. Ten chicks were thus obtained from the 16 eggs. One of these died soon after hatching, and the loss was not called to my attention until too late to examine for cause of death. One died, probably, from contusion of the brain,—from having flown against the cage. One died from an unaccountable rupture of the gizzard. Neither of these birds showed the slightest disease of liver or cæca. The remaining 7 are vigorous specimens, and, though hatched September 13, are well feathered and sufficiently grown to shift for themselves and endure frosty nights without brooder heat.

In addition to the above I obtained August 19, from Mr. Merrill, 11 quail chicks just out of the incubator. These were reared in a brooder, and are all alive and well to date. They have attained very nearly adult growth.

A feature of the season's work, upon which, in fact, the measure of success attained has depended, has been extermination of vermin from the premises. Rats are continually invading the place from a public dump along the Beaver Brook close by. Early in the season we found one bantam hen killed by a skunk. A number of traps were kept continuously set in all likely places, are now, and ever shall be. The result was rather surprising for practically a city location. In all 17 skunks were caught and unnumbered rats, every one, practically, that set foot on the premises, and before he had done any damage.

With the breeding stock on hand, prospects are bright for the rearing of considerable numbers of bobwhite and ruffed grouse the coming season. Eight eggs were obtained from Canada, as above stated, but none of them hatched. I desire especially next season to obtain eggs of the ruffed grouse from a very wide range,—if possible, from Canada to Georgia or Florida,—both in order to study regional variations of the species, and to study comparative size, vigor and resistance to disease of different strains, in order to obtain the best possible stock with which to establish a domesticated breed. Any assistance in the way of obtaining unincubated eggs which the Massachusetts commission or the game commissions of other States can render will be very gratefully received and duly acknowledged.



TYPE OF PEN FOUND MOST EFFICIENT FOR WINTERING QUAIL AT SUTTON HATCHERY.

A grant of \$500 from the Carnegie Institution has enabled me to carry on the work this season, paying for necessary assistance, brooders, cages, food and all other supplies and equipment. This assistance is most gratefully acknowledged. With the plant in its present form the work of the next few years will be greatly facilitated.

Respectfully submitted,

(Signed)

C. F. HODGE.

Quail. — That portion of Superintendent Merrill's report which concerns the rearing of quail in confinement follows: —

Last year's experience with quail showed two principal difficulties to be overcome: maintaining a satisfactory brood stock and hatching the eggs successfully. Rearing the young appeared to be less a problem, assuming that diseases, the one obstacle previously met with, could be avoided.

This season the conditions were somewhat reversed, but a distinct gain was made. Losses in the brood stock were experienced, but more was learned about the diseases, and, further, no part of the loss could be attributed to confinement aside from the part played by disease. The laying, fertilization of the eggs and hatching were very satisfactory, and the way cleared somewhat for the control of egg production and its increase above the normal. The rearing was much less successful. The diseases that were the source of trouble the previous year were avoided wholly, but the chicks showed less vigor, and in the younger stages of their growth, generally under four days, the loss was heavy. No cause could be assigned for the loss other than low vitality, but the case did not parallel that of the grouse, for none showed the excessive feebleness that the grouse did when hatched. The food was the same as that given the year before, with the exception of less insect food, and greater attention to feeding, watering and regulating temperature. After the first week, the growth and health of the birds were satisfactory; no disease appeared, and the loss was very slight, being due largely to panics in the night on three occasions, when several birds beat themselves to death against the wires.

Ten new pens were finished in December, and immediately thereafter were partly stocked with female quail from Alabama. This lot was evidently diseased at time of shipment, for one-fourth arrived dead, but the subsequent loss was not heavy at any time, and was even lighter in the severest winter weather than after the opening of spring. This lot supplied the breeding females mainly, and were good breeders. They laid somewhat later than the old stock and native birds, but laid satisfactorily. Their eggs were fertile and hatched well. It could not be determined whether the chicks from their eggs were any weaker, or in any way different from the other chicks. The unusually severe win-

ter weather was somewhat uncomfortable for them, but did no apparent harm. They avoided the severest cold by going under the snow; not plunging in, like the grouse, but seeking the advantage of a cavity where the snow was held up by brush or a stump and working in two or three feet. The old stock of quail and young reared the previous season passed the coldest weather on the snow; they were never seen burrowing into the snow, and rarely used the shelters provided for them to pass the night.

The December shipment was followed by a shipment in March from the same place, but, although they seemed in excellent condition on arrival, they were infected with a highly contagious disease, that destroyed most of them within a week, and exterminated the lot within three weeks.

At the opening of the breeding season in 1906 the breeding quail numbered 47; at the close of the season a partial count indicated 30. At the beginning of winter, when they could be counted, exactly 21 were found. At the opening of the breeding season of 1907 this number was reduced to 12. In a few cases a flight against the side or top of the pen, as might happen by being unexpectedly startled, was believed to be the cause of death, but this was exceptional, for the quail quickly learn and exercise caution in flight when in pens. Nearly all the quail found dead, when not too far decayed, showed the appearance of intestinal disease, and as all had been exposed to such disease it seems probable that they carried the infection into the pens, where they fell victims, sometimes immediately, sometimes months later, accordingly as they received the infection or had their power of resistance to it weakened. It was noted in several instances that the loss of the first bird was quickly followed by the loss of the rest in the pen.

In 1907 the experiences were somewhat the same, — several lots came through the season without loss, others suffered a total or partial loss. In two lots the birds were in pens adjacent to those in which birds died of the so-called Alabama quail disease, and doubtless received the infection from that source. In both pens only a few days elapsed between the death of the first and the last birds. In between these pens four, occupied by birds from the same lot, went through the breeding season with the loss of only 1 bird out of 12. In the pens occupied the previous year the loss was heavier, but soon after the close of the breeding season a weazel destroyed all the birds but one. This one, a female, was put in a pen with a pair of quail, and was promptly killed by them, being only the second instance here where violence has been shown by one quail to another. Difficulty in finding the dead birds in a condition fresh enough for examination has prevented the determination of the disease, except in a few cases. These proved the agent to be a parasite, *Coccidium*. The *Amœba* was reported in only one adult bird.

The birds received in March were destroyed by a bacterial disease. Of the 25 large pens, 6, covering 2,880 square feet, have not been occu-

pied, and may be considered safe for another season's work; 19, covering 11,720 square feet, have been used, and may be considered infected. For how long would be a difficult question to answer, but certainly for another year, probably for two. In a case where pheasants were destroyed by *Coccidia* last year, the ground where they travelled was infected this year, and loss resulted from placing birds there. The pens considered unsafe should be disinfected, if it is possible to do it thoroughly; but a quarter of an acre of rough ground, littered with brush, stones and stumps, and having patches of thick vegetation, presents a difficult problem when it is required to make it safe for such birds as quail, which pick and feed on every inch of the bottom, and scratch deep into the sod. I recommend that a liquid disinfectant be used, first burning the pens over lightly to clean out the dead leaves and vegetation of the previous year's growth, wetting around the boarding of the pens and any vegetation it is desired to save with the disinfectant as the fire progresses.

The breeding lots were substantially the same as the year before, one male to one, two or three females, and the laying was fully as satisfactory, the average being about 13 eggs and percentage fertilized about 90. One lot of birds in a small pen at the barn is considered separately. These were birds reared the season before, two females and two males; the first male died and another one was put in early in the season.

The first egg was taken June 2; the last, after the middle of September. One bird first laid 10 eggs, then ceased; but after a brief time both birds began laying together, and continued until the eggs numbered 76. They laid practically all of their eggs in the same nests, making four, and using these interchangeably when disturbed by having a portion of their eggs taken. The first eggs were well fertilized, 9 out of 10 hatching; succeeding lots showed more sterile eggs, until at the end practically none were good. The number of fertile and unfertile eggs were equally divided, 38 of each; considering only the fertile ones, these birds exceeded the others in prolificness.

The conditions were not especially favorable for this productiveness, and it may be safely taken as an indication of the capacity of the quail under domestication. The pen was small, containing 288 square feet, and had but a slight amount of vegetation. The birds were only slightly stimulated, being fed moderately with maggots when it became evident that they would lay an unusual number of eggs; otherwise their food was the same as that of the other quail, though with much less opportunity to secure insect food.

The laying birds were the only females of the lot reared the previous year, and a comparison can only be made with wild birds captured, which appear in captivity to closely follow their habit and lay only an ordinary nesting. The performance of those two birds seems a hopeful break in this instinct, and if it is continued in the birds for breeding the next season, some of the second generation grown here

will make a most important step in the progress of the work, and a very satisfactory one if the same results can be obtained and the eggs as well fertilized as in the smaller lots. Better fertilization possibly may be secured by having the birds in pairs, by changing the males, or by having lone males in adjoining pens, as a stimulus to the breeding males. This problem should be worked out in succeeding seasons, and in preparation for it the breeding lots should be arranged for the experiments suggested. The two females died two months after the laying season, and on examination were found infected with *Coccidia*. These parasites were the evident cause of death, but impaired vitality from such heavy laying must have been a contributory cause, for the birds had been in the pen a year, and were exposed to Coccidial infection in the beginning.

The work with incubators was very satisfactory and promises better results than by the use of hens; the loss from dead embryos was less than the usual breakage by hens, and the chicks were strong, except for a few crippled ones, due to variable heat. The incubators were run the same as for pheasants, more airing and cooling and extra moisture being supplied. This and some other parts of the work are proper subjects for careful scientific work, and should be done apart from the regular work, until the proper methods are exactly defined, and can be followed as a matter of routine.

The young quail were fed on dried ant eggs and maggots, live ant eggs and insects being added when obtainable, and fruit, seeds and grain, as the birds grew old enough to take this food. The ant eggs and maggots are a dependable supply of food, and some of the best results were obtained from using these exclusively. The value of insect food is probably higher, but as it could not be used very largely, results cannot be stated. Its use is attended with many difficulties, principally in collecting it, so as to feed the birds regularly, and its value in very extensive feeding operations is problematic, for the collectible supply within reasonable distance of the pens is uncertain, and sometimes wanting. A more varied and regular supply would be of great importance, and should be taken up and studied as something very essential to doing the work on a large scale. There is no question but what insects and the chase for them produce more vigorous birds, but possibly harm is done through depending on an uncertain supply and changing to other food. Fresh ant eggs can be obtained very regularly, but a large stock of birds would soon exhaust the supply within a radius that would be practicable for collecting, and getting these, as well as insects that could be collected only in moderate numbers, would require an amount of time practically prohibitive where it is desired to do considerable work.

The supply of ant eggs might be increased by scattering about flat stones or short lengths of boards or slabs for them to work under; a suitable succession of vegetation might produce a more regular supply of *Aphides* in a season favorable for them. It may be possible to trap

grasshoppers, crickets and such insects, or night flying insects, or to net them on a large scale by sweeping grass or bushes. Maggots can be readily turned into flies, and by breeding the house fly the expense for material would be inconsiderable. Many of these suggestions have been tried with varying success, but no unfavorable conclusion reached until more thorough trials have been made.

The young have been reared in small pens, but the possible advantages of a large pen should be tried, especially one of light construction, that could be moved frequently to fresh ground, where each removal would mean a fresh supply of insects.

The work of cultivating natural plant food was continued, and is of considerable value in supplying a variety of desirable food, and at the present time is of especial value in determining what can be profitably done. The value of domestic berries and their wild varieties is settled, and provision made for an ample supply. As the season for these berries passes, the elderberry has been found most desirable, since it is easily fed, and more eagerly eaten than anything else at that time, and can be given a longer season by planting in warm places for early berries and in half-shady places at the springs for late berries. Probably nothing can be cultivated that will yield such enormous returns for labor expended and ground used, and as it can be easily dried for winter use, it has been planted more extensively than anything else. Weed seeds are so eagerly eaten that it is a question if they should not be collected or cultivated as regular food. A field where ragweed or pigweed would grow up thick, with a small sowing of grain or millet, would, if reaped at the right stage, supply a combined grain and green food of excellent quality.

Respectfully submitted,

ARTHUR MERRILL, *Superintendent.*

Gray Squirrels. — In certain sections of the State the scarcity of gray squirrels has led to a considerable interest in securing conditions which may make for an increase in numbers. While beyond question the animal is of unusual æsthetic value, and serves as a healthy and pleasant stimulus to those who roam the wild woods or parks, there is another side to the question which must not be overlooked by the enthusiastic champions of this animal. This office has received complaints from sections of Cambridge, Newton Highlands and elsewhere, which all agree in testifying that the squirrels may become too numerous, and thus not only annoying but even very destructive, not alone to the eggs and young of birds, but to trees, fruit and buildings. As in the case of foxes and deer, much depends upon the point of view whether these animals are on the whole so beneficial as

to be worthy of a high degree of protection without guaranteeing adequate protection to property owners. By the extermination of the panther and wildcat, and the slaughter of hawks and owls, man has removed the chief checks to the undue increase of these animals, and is thereby compelled to assume the function of regulating the numbers. Just as a beautiful flower by being in the wrong location may become a noxious weed, so the beautiful gray squirrel may become but a graceful rat, with all its cousin's indiscriminating destructiveness.

We again repeat most emphatically the opinions expressed in our two previous reports, that the greatest hope for the continued maintenance and complete utilization of our useful fish, birds and mammals lies in greater attention to well-considered attempts at artificial propagation, by individual and co-operative methods, and by the institution of permanent sanctuaries or reserves for breeding places, rather than by multiplying complicated and trivial restrictive laws, which are changed each year according as the representatives of any section of the State may become interested in some one phase of a great problem. We need more general laws based upon broad, sound principles, with the elimination of local trivial restrictions.

Side Hunts. — There still persists in certain sections of New England that relic of barbarism the so-called "side hunt," where a "record" of slaughter is sought. It is not a record of difficult shots which have brought success, but rather a noxious attempt to collect the greatest possible number and variety of birds and animals which by any stretch of the law and of so-called sporting "imagination" can be construed as "game."

Such a contest involves too little of the true elevating spirit of outdoor life, and offers little attraction to the true sportsman. "A true sportsman," said Dr. Van Dyke, "is a man who finds his recreation in a fair and exciting effort to get something which is made for human use in a way that involves some hardship, a little risk, a good deal of skill and patience, and plenty of out-of-door life." The "side hunt" provokes reckless and wasteful destruction of life, and tends to promote that deplorable state of mind which manifests itself as fish and game "hoggishness."

These are typical score cards, made in northern Worcester County in the fall of 1907.

The score cards vary in different sections. In many cases beneficial birds which are protected by law are included in these lists.

A sample list of the items and the scores is given below.

List of Game to be counted.

	Points.	Number killed.
Eagle,	500	—
Hen hawk,	100	1
Owl,	200	—
Snipe,	100	—
Partridge,	100	5
Quail,	100	—
Woodcock,	100	2
Crow,	25	5
Blue jay,	10	20
Duck,	150	3
Kingfisher,	50	—
Loon,	300	—
Sparrow hawk,	50	—
Pigeon, wild,	200	—
Turtle dove,	200	—
Coon,	300	2
Woodchuck,	100	—
Gray squirrel,	100	40
Red squirrel,	10	60
Rabbit,	25	15
Hare,	100	—
Mink,	150	—
Fox, red,	300	12
Fox, black,	500	—
Fox, silver,	500	—
Hedgehog,	200	—
Flying squirrel,	25	—
Weasel,	125	—
Muskrat.	50	—

Total game birds killed, 10

Non-edible and non-game birds killed, 26

In another, the total killing included 9 ruffed grouse, 1 fox, 30 red squirrels, 20 gray squirrels, 2 rabbits and 1 coon.

The score card and the results of another two days' batt(ue):—

List and Count of Game.

	Points.	Number killed.
Wild goose,	500	—
Wild duck,	500	8
Fox,	500	—
Mink,	500	—
Coon,	400	—
Partridge,	300	4
Woodcock,	250	—
Hawk,	400	8
Owl,	200	4
Weasel,	200	—
Woodchuck,	250	—
Snipe,	150	—
Rabbit,	150	—
Crow,	150	150 ¹
Blue jay,	100	20
Muskrat,	50	3
Red squirrel,	50	40
Gray squirrel,	250	25
Flying squirrel,	50	—
Total game birds killed,		12
Non-edible and non-game birds killed,		182

The food habits of the common crow form the subject of Bulletin No. 6 of the Biological Survey.² The results of examinations of 909 stomachs of crows are tabulated in the report. Of this number, 78 contained mice, they being fourth in order of importance on the list of animal food for the year. Professor Barrows says: "There is abundant proof from several sources that crows often capture living mice, particularly the short-tailed field mice, which build their nests usually on the surface of the ground, among the roots of grass. Here the crows discover them, and, tearing the nest to pieces, devour the young and not infrequently catch the adults as well. By far the greater number of the mice found in the stomachs were meadow mice, or voles

¹ In connection with this massacre of crows should be studied the reports of the Biological Survey of the National Department of Agriculture.

² The Common Crow of the United States, Walter B. Barrows and E. A. Schwartz, 1895.

(genus *Microtus*), and most of them were the common species (*Microtus pennsylvanicus*).

In midwinter, when the ground is covered with snow, crows find but few field mice; but as spring approaches and the snow begins to melt on the meadows the bulky grass nests of the mice are first exposed. The crows may then be seen searching the meadows for them. They alight near the openings in the snow, pounce upon the nests, tear them to pieces, and as the mice scamper out the crows often succeed in capturing them. Later in the spring, when crows feed their nestlings, insects are more abundant and the nests of mice are hidden in the growing grass, so that relatively fewer mice are eaten. Still later, after the young crows have left their nests and mowing machines have once more exposed mouse nests in the meadows, crows again spend much time searching for young meadow mice.

It is of interest to note that complaints of recent depredations of field mice are especially numerous from sections of the United States where for several years past bounties have been paid for killing crows.¹

Deer. — Deer have continued to increase in spite of considerable illegal shooting and the killing of 25 deer by steam and trolley cars.

Without doubt much damage is done to farmers' crops by deer for which complete and facile remuneration is not obtainable. The writer is, however, warranted in saying that the commissioners and their paid deputies will gladly extend every possible assistance to secure justice for any *bona fide* claimant. The total disbursements of the Commonwealth during the fiscal year of 1907 were \$2,912.78. The value of the increase in the number of deer cannot be less than \$30,000, figured even at the value of the dressed meat as food.

ENFORCEMENT OF LAW AND SUGGESTIONS FOR LEGISLATION.

Classification of Arrests during the Year 1907.

FORM OF VIOLATION.	Counts.
Taking shellfish in polluted waters,	78
Fishing in closed ponds,	19
Hunting on Lord's Day,	69
Hunting without license (aliens),	42
Having short lobsters,	16

¹ From Bulletin No. 31, Biological Survey, United States Department of Agriculture, An Economic Study of Field Mice, by David E. Lantz, issued Oct. 28, 1907, p. 50.

ENFORCEMENT OF LAW AND SUGGESTIONS FOR LEGISLATION — *Concluded.*

Classification of Arrests during the Year 1907 — Concluded.

FORM OF VIOLATION.	Counts.
Dogs chasing deer,	5
Killing song birds,	10
Illegal possession of game,	22
Having short trout,	17
Killing deer,	2
Using more than ten hooks,	29
Setting snares or snaring game,	3
Taking scallops under two inches,	4
Hunting with ferret,	4
Pursuing deer with intent to kill,	4
Having smelts in close season,	3
Using more than one hook on stocked pond,	2
Taking or killing eagle,	2
Dynamiting waters,	6
Seining in Buzzards Bay,	3
Setting nets, chapter 301, Acts of 1897,	1
Spearing fish,	1
Taking short pickerel,	3
Taking short bass,	4
Killing wood duck,	2
Snaring trout,	1
Seining in pond,	2
Hunting without license (non-residents),	4
Having scallops in close season,	5
Having trout in close season,	1
Trespassing on posted land for purpose of hunting,	2
Pursuing wild fowl with power boat,	7
Possession of feathers of birds for millinery,	3
Killing or possession of heron,	2
Shooting gulls,	1
Setting forest fires,	5
Using set lines,	2
Taking clams illegally (Ipswich),	2
Cutting away lobster traps,	2
Total number of counts,	390

Fish and Game Laws and their Enforcement.—Summary of Law-enforcement Work during the Year 1907.

Total fines imposed,	\$3,470 20
Fines from arrests by paid deputies,	1,921 20
Fines from arrests by unpaid deputies,	1,549 00
Total number of counts taken to court,	390
Total number of persons arrested,	358
Convictions,	327
Discharged,	56
Defaulted,	7
Cases filed,	63

Itemized List of Moneys received by the Commissioners on Fisheries and Game during the Year 1907 and paid to the Treasurer and Receiver-General.

RECEIVED FOR—	Amount.
Issuance of non-resident hunters' licenses, under chapter 198, Acts of 1907,	\$828 00
Sale of egg-bearing lobsters to the United States Bureau of Fisheries stations,	655 25
Heath-hen fund, chapter 504, Acts of 1907,	590 00
Forfeitures (deer, moose, etc.), ¹	386 77
Forfeitures (pike perch),	208 70
Forfeitures (seines or nets),	8 50
	\$2,767 22

¹ Deposited with Treasurer of the Commonwealth pending the decision of certain legal questions.

There have been no applications for the inspection of fish under the Acts of 1902, chapter 138, and no fees have been received.

Enforcement of Law.—Our deputies are instructed to extend every possible assistance to the authorities of adjacent States. At many points on the State lines professional violators ply their vocation, since here are offered peculiar opportunities to escape in case of liability of apprehension. It would be of great advantage to the public if some plan could be devised whereby it would be possible for adjoining States to reciprocally deputize the State officers who enforce the fish and game laws. The chief difficulty appears to rest upon the apparent impossibility for one State to commission citizens of a second State as

officers of the first State, though Pennsylvania and New Jersey have devised a plan which promises to meet existing conditions.

Many nests and young birds are destroyed by dogs running at large. Other States have recognized this fact, and have enacted various laws.

Michigan permits the training of dogs fifteen days only before the open season for ruffed grouse, and prohibits the possession of firearms while the person is so engaged. Minnesota does not allow pointers and setters to be used or run in fields or upon lands in which game birds may be found during August, or at any time except in the open season for such birds. Pennsylvania permits dogs to be trained by their masters upon any game, except deer, from August 1 to January 1, but prescribes that no injury shall be inflicted upon such game. South Dakota has gone considerably further, and declares that any person travelling in any manner in any part of the State, outside the immediate bounds of the inhabited parts of any village, town or city, in possession of any kind of shotgun and ammunition, with dogs ordinarily used for hunting game birds, from July 1 to September 1, shall be presumed to have violated the laws respecting game birds.¹

The special attention of town authorities where bounties are paid upon hawks and owls is directed to the fact that under the present laws bounties may legally be paid only upon the goshawk, red-tailed, red-shouldered, Cooper's, sharp-shinned and duck hawks, and upon the barred and great horned owls. Eagles are especial marks, but are now protected by special law.

The right to search for game illegally held is perhaps one of the most important functions of a warden, and is necessary for efficient protection, for in no other way can illicit traffic in game be eradicated. This authority has led to the discovery of large numbers of birds and quantities of game in some of the cities of the United States, and the suppression of a traffic only suspected before. It has been only by means of this process that illegal interstate commerce in game has been stopped. So hard have the market hunters in the Mississippi valley been pushed that in order to get their illegal shipments to the city markets they have packed the game in butter tubs or egg cases, labelling the shipment "butter" or "eggs." Other devices also for evading the game laws have been adopted; but the climax was reached

¹ From Bulletin No. 28, Biological Survey, United States Department of Agriculture, Game Commissions and Wardens, their Appointment, Powers and Duties, issued Aug. 1, 1907, p. 89.

when certain shippers packed their game in a coffin box and shipped it as a corpse, accompanied by a false death certificate. Somewhat more troublesome, if not so gruesome, was the resort to bales of hay, the game being placed in the center of a car with the bales of hay piled about it.

Search without Warrant.—Seventeen States and the District of Columbia specifically provide that wardens or other officers may search certain designated places without a warrant. While the statutes vary widely in language, the substance is the same, and the officers are clothed with power to accomplish the same results. It is interesting to note that most of the States granting this power are western or central; of the southern States only Louisiana is included, and of the eastern only Maine, Connecticut, New Jersey, New York and Pennsylvania. Arkansas has a provision permitting common carriers to open and examine any package delivered to them for transportation out of the State that they suspect contains game, and the Texas game law of 1907 contains a similar provision, as follows:—

That such express company, or other common carrier, or its agents, servants or employees, shall have the privilege of examining any suspected package for the purpose of determining whether such package contains any of the articles mentioned herein [all game].—House Bill No. 345, section 10.

Ohio does not vest her officers with power to search without warrant, but provides that in case of refusal of the owner or person in charge of any package, box, coat, clothing or other receptacle to permit a warden or officer to inspect them, such officer may procure a search warrant to do so from any competent court. Penalizing the refusal of any person to permit an inspection of his place or receptacles, the interposition of or hindrance or interference with such search accomplishes much the same result as direct authorization of search with or without warrant. Such provisions are as follows:—

Kansas.—Persons engaged in trade of meat, fish and game are required, under penalty of \$10 to \$50, to permit an inspection of their places of business by a warden.

Minnesota.—Any person in possession or control, or in charge of any hotel, restaurant, storage plant or house commonly used in storing meat, game or fish for private parties, refusing or failing to permit any member of the game commission or its wardens to enter such place or receptacle therein for the purpose of making an inspection thereof, is punishable by a fine of \$50 to \$100, or imprisonment for thirty to ninety days.

West Virginia.—Any person who hinders, obstructs or interferes with a game warden in the discharge of any of his duties (among which is the duty to search for evidence of the violation of law) is punishable by a fine of \$10 to \$50, and in default of payment shall be imprisoned until it is paid, but not exceeding thirty days.

Michigan, Oregon and West Virginia render evasions of their laws still more difficult or more certain of detection by making hindrance or obstruction of officers in their search for evidence or fruits of violations *prima facie* evidence of violation of law. The Michigan provision is as follows:—

Any hindrance or interference, or attempt at hindrance, with any search and examination shall be *prima facie* evidence of a violation of the law by the party or parties who hinder or interfere with such search and examination.

One phase of the subject, however, deserves fuller and more extended presentation. A number of cases involving the game laws have gone to the courts of last resort upon the ground that the fine authorized to be inflicted was excessive, and that the statute was therefore in contravention of that clause of the State Constitution prohibiting the imposition of excessive fines. The courts without exception in these cases have sustained the law, and have held the following fines not to be excessive: \$1 for each lobster in Maine (*State v. Craig*, 13 Atl. 129); \$5 for each lobster in Maine (*State v. Lubeck*, 45 Atl. 520); \$5 for each prairie chicken in Nebraska (*McMahon v. State*, 97 N. W. 1035); \$10 for each duck in Minnesota (*State v. Poole*, 100 N. W. 647); \$20 for each bird in Rhode Island (*In re Stone*, 41 Atl. 658; 21 R. I. 14); \$50 to \$75 for a wild duck in Wisconsin (*State v. DeLano*, 49 N. W. 808); and \$100 for each deer in Minnesota (*State v. Rodman*, 59 N. W. 1098; 58 Minn. 393). One of the clearest and most satisfactory expositions of this question is found in the case of *State v. Rodman* (Minn., 1894), 59 N. W. 1098. In this case, which involved the unlawful possession of 58 deer, the maximum punishment provided by the statute was a fine of \$5,800, or imprisonment in the county jail for about sixteen years. In the course of its decision the court said:—

While the fines imposed are certainly large, yet we cannot say that they are excessive, in a constitutional sense. A large discretion is necessarily vested in the Legislature to impose penalties sufficient to prevent the commission of an offence, and it would have to be an extreme case to warrant the courts in holding that the constitutional limit had been transcended.

Ten years later the same court (the Supreme Court of Minnesota), as already explained, sustained the lower court in the imposition of a much larger fine — \$20,000 — for having in possession 2,000 wild ducks with intent to sell them.

One of the greatest obstacles to effective game-law enforcement is the modern cold-storage plant and the facility it offers for concealment of game. The ease and certainty with which dead game may be preserved even in hot weather removes all limitation formerly imposed

by that condition, and stimulates the killing of vastly larger quantities than in days before this invention. It is therefore a direct incentive to the unlimited destruction of game. It has furnished a defence often invoked in prosecutions for possession of game in close season, when the defendant has asserted that the game was lawfully taken in the open season and held in cold storage. It is often difficult, if not impossible, for the State to controvert this defence. Hotels, restaurants and clubs are therefore able to serve game to their guests throughout the close season, and many other avenues of illicit commerce in game are thereby opened. It has proved such a menace to the preservation of game in Minnesota that in 1905 the Legislature prohibited, in the following terms, the placing of game in any cold-storage plant:—

The placing or receiving within, or storage of any game bird or game animal, or any part thereof, in any cold-storage plant, is hereby prohibited and made unlawful.

Other States have placed restrictions on the storing of game. As an example, Nebraska has made it unlawful to store game, except during the open season and five days thereafter, when stored for the person lawfully in possession thereof, and at any time when it has been lawfully imported into the State. This limitation is followed by a positive prohibition of the possession or serving of game by hotels, restaurants, cafes and boarding houses to their patrons in close season. In Colorado a permit from the game commissioner is required to store game. In several States the owners, proprietors or managers of cold-storage plants are required to permit the game wardens to inspect all places where meat, fish and game are kept for sale or shipment, or stored for pay, and those storing such articles are required to permit inspection. New York defines the limitations on the privilege of storing game in no uncertain terms: dealers in game may store their stock on hand at the commencement of the close season upon giving bond in such amount and under such restrictions as the forest, fish and game commissioner may prescribe, and with the further restrictions that they will not sell, give away or otherwise dispose of the game in close season, and that they will not violate the law in any way. The prostitution of the cold-storage plant to purposes of illicit traffic in game is fortunately disappearing under recent legislation, and through the vigilance of the officers charged with the enforcement of the game laws.

The case of *Haggerty v. St. Louis Ice Manufacturing and Storage Company* (44 S. W. 1114), decided by the Supreme Court of Missouri in 1898, involved an interesting question of contract connected with the storage of game. Haggerty, game dealer in St. Louis, had stored in 1892 with the defendant company a large quantity of game, to be withdrawn during the next open season. In 1893, when the game was

removed, the owner found it worthless from decay. A suit was instituted for the recovery of \$7,000 damages from the storage company. The company demurred to the complaint upon the ground that the contract of storage was in violation of the game law, which prohibited possession of game in close season. The demurrer was sustained and on appeal to the Supreme Court the judgment was affirmed.¹

Large numbers of ruffed grouse and other game are disposed of in various ways distinctly contrary to the spirit of the non-sale law, but in such a manner as to successfully be within the strict letter. Public opinion should take up this type of violation.

Forest Fires. — These do enormous damage to bird life by the destruction of nesting sites, young birds, eggs and probably not a few adults. Many incipient forest fires have been extinguished by our deputies in various parts of the State.

Deputy James E. Bemis says in his annual report: "Have watched for forest fires and put out one or more every day for some weeks in the dry season. Have twice called out the fire department for assistance."

Our deputies have secured five convictions of persons illegally setting fires in the woods.

The deputy service is rapidly becoming that of a trained and active rural police, whose duty is to protect the forests and their inhabitants. The majority are adept hunters, whose interest in the wellbeing of the property under their charge is greater than the mere "job."

Recommendations for Legislation. — We especially respectfully recommend the passage of laws designed to accomplish the following purposes: —

1. To protect the lobster from excessive and destructive fishing.
2. To prevent the sale of lobster meat prepared or placed on the market under unsanitary conditions.
3. More adequate and economical facilities for propagating and distributing food fish and useful birds.
4. Development of the shellfisheries below high-water mark in such a manner as to increase the economic yield of food

¹ From Bulletin No. 28, Biological Survey, United States Department of Agriculture, Game Commissions and Wardens, their Appointment, Powers and Duties, issued Aug. 1, 1907.

material; to furnish wider opportunities for remunerative employment of skilled and unskilled labor; to increase the taxable property of the shore towns and cities; and to bring revenue to the Commonwealth.

5. Giving to the fish and game commission and their salaried deputies the same powers for the enforcement of the fish and game laws as is now given to the district police for the enforcement of the general laws, including the right to carry weapons, etc., to serve warrants, and to summon assistance.

6. Suitable protection for deer, and for property liable to injury by deer.

7. Definition as to what constitutes hunting on the Lord's Day.

8. A perfecting clause to the law licensing unnaturalized, foreign-born persons to hunt within the Commonwealth.

9. Suitable protection for pheasants.

10. Prohibition of all hunting from January 1 until the beginning of the next open season on game in order that better protection may be given to the useful birds, and that an increasing number of woodcock, ducks and other species of birds may breed within this State.

11. It should be lawful at any time for any person, firm or corporation, dealing in game or engaged in the cold-storage business, to buy or sell hares or rabbits which have not been taken or killed contrary to the laws of this or any other State.

12. Such an extension of the right of search law as our State Constitution may permit, thus making possible a more satisfactory enforcement of the laws relating to the preservation of birds and other useful animals.

13. Amendment of section 132, chapter 91 of the Revised Laws, relative to fishing with seines, dip-nets, etc., in fresh water.

14. Perfecting clause to chapter 296 of the Acts of 1907, relative to the sale of artificially reared trout.

COURTESIES.

It is a pleasure again to acknowledge the assistance so courteously rendered to the commission by Mr. Arthur L. Millett, local agent of the United States Bureau of Fisheries at Gloucester.

ter, and by Mr. F. F. Dimick, the efficient secretary of the Boston Fish Bureau.

Permits to hold in confinement egg-bearing lobsters for collection by the agents of this commission, according to chapter 408, Acts of 1904, were issued to 480 fishermen and dealers.

Permits for taking birds and eggs under section 9, chapter 92 of the Revised Laws, as amended by chapter 287, Acts of 1903, were issued to the following-named persons:—

Frank S. Aiken, Fall River.
 Chester A. Reed, Worcester.
 A. H. Tuttle, Cambridge.
 William Dearden, Springfield.
 George M. Gray, Woods Hole.
 William Brewster, Concord.
 Frederick E. Waterman, Fall River.
 John H. Hardy, Jr., Boston.
 W. H. Forbush, Wareham.
 F. H. Carpenter, Seekonk.
 Owen Durfee, Fall River.
 F. B. McKechnie, Boston.

F. H. Kennard, Boston.
 A. C. Bent, Taunton.
 F. H. Scott, Westfield.
 Nathan F. Stone, Worcester.
 A. E. Preble, Portsmouth, N. H.
 B. G. Willard, Millis.
 J. A. Sinclair, Wilmington.
 Haynes H. Chilson, Northampton.
 J. A. Barton, Fitchburg.
 Chester S. Day, Boston.
 Clarence Birdseye, Amherst.

Permits to have in possession for propagation purposes ducks of any species were issued to:—

A. V. Freeman, South Duxbury.

Guilford C. Hathaway and Benj. W. Brown,
 Fall River.

Permit to have in possession for purposes of propagation wild ducks was issued to:—

William French, Fall River.

Permit to have in possession black bass, trout and pickerel at any season, of any size, also to use minnow traps and casting net, was issued to:—

W. Endicott Dexter, Boston.

Permit to have in possession native birds for purposes of observation and breeding was issued to:—

Dr. J. C. Shaw, New Bedford.

Permit to take eggs, young and adults of the laughing gull, Wilson's tern and Roseate tern was issued to:—

Clarence E. Birdseye, Woods Hole.

Permit to take and have in possession eggs of the ruffed grouse and the birds which hatch therefrom, also quail for purposes of propagation and study, was issued to:—

C. F. Hodge, Worcester.

Permission to have live Alabama quail in possession was issued to:—

Louis C. Tilton, Boston.

Permission to have in possession for purposes of propagation live quail was given to:—

William Albrecht, Sharon.

Permit to have in possession gray squirrels, to be liberated on reaching a proper age, was given to:—

M. J. Whittall, Worcester.

Permit to trap quail for purposes of propagation was issued to:—

C. F. Hodge, Worcester.

Permit to have in possession and to transport from Worcester to New York ruffed grouse and quail was issued to:—

C. F. Hodge, Worcester.

Permit to have in possession lobsters of any size for use in connection with scientific work was issued to:—

Marine Biological Laboratory, Woods Hole.

Permits to take sand eels for bait, under chapter 164, Acts of 1902, were issued to the following persons:—

A. P. Hilton, Newburyport.

Henry L. Godfrey, Newburyport.

R. L. Gove & Son, Ipswich.

Charles R. Coullard, Newburyport.

James Crooks, Newburyport.

Permit to collect scallops of any size, and to use a sweep seine and nets for catching fish, to be used solely for scientific purposes, was issued to:—

Marine Biological Laboratory, Woods Hole.

Permit to take lamprey eels for scientific purposes was issued to:—

George M. Gray, Curator, Marine Biological Laboratory, Woods Hole.

Permission was given to take white perch by seines or nets for the purpose of transferring them from the waters in which they were taken to other waters in the town of Plymouth to:—

W. C. Hathaway, Plymouth.

Permit to take large-mouthed black bass from Housatonic River in Sheffield for scientific or exhibition purposes was issued to:—

Richard E. Follett, Boston.

Permit to take from Housatonic River in Sheffield large and small-mouthed bass, sunfish, pickerel, yellow perch, rock bass and dace, to be used for scientific or exhibition purposes, was issued to:—

Richard E. Follett, Boston.

Respectfully submitted,

GEORGE W. FIELD.

EDWARD A. BRACKETT.

JOHN W. DELANO.

APPENDICES.

[A.]

LIST OF COMMISSIONERS.

UNITED STATES BUREAU OF FISHERIES, WASHINGTON, D. C.

George M. Bowers, Commissioner.

Hugh M. Smith, Deputy Commissioner.

Irving H. Dunlap, Chief Clerk.

John W. Titcomb, Assistant in charge of Division of Fish Culture.

Barton W. Everman, Assistant in charge of Division of Inquiry Respecting Food Fishes.

A. B. Alexander, Assistant in charge of Division of Statistics and Methods.

Hector Von Bayer, Architect and Engineer.

Superintendents of United States Fisheries Stations.

E. E. Race, Green Lake, Me.

Charles G. Atkins, Craig Brook, East Orland, Me.

E. E. Hahn, Boothbay Harbor, Me.

W. F. Hubbard, Nashua, N. H.

E. N. Carter, St. Johnsbury, Vt.

C. G. Corliss, Gloucester, Mass.

E. F. Locke, Woods Hole, Mass.

Chester K. Green, Cape Vincent, N. Y.

L. G. Harron, Washington, D. C.

George A. Seagle, Wytheville, Va.

R. K. Robinson, White Sulphur Springs, W. Va.

H. D. Allen, Beaufort, N. C.

J. J. Stranahan, Cold Springs, Bullochville, Ga.

C. W. Burnham, Tupelo, Miss.

S. G. Worth, Edenton, N. C.

A. G. Keesecker, Fishery, Tenn.

S. W. Downing, Put-in-Bay, O.

Frank N. Clark, Northville, Mich.

S. P. Wires, Duluth, Minn.

S. P. Bartlett, Quincy, Ill.

R. S. Johnson, Manchester, Ia.

H. D. Dean, Neosho, Mo.

J. L. Leary, San Marcos, Tex.

W. T. Thompson, Leadville, Col.

D. C. Booth, Spearfish, S. D.

James A. Henshall, Bozeman, Mont.

G. H. Lambson, Baird, Cal.
 Henry O'Malley, Clackamas, Ore.
 A. H. Dinsmore, Baker Lake, Wash.
 W. K. Hancock, Yes Lake, Alaska.
 M. F. Stapleton, Mammoth Spring, Ark.
 Claudius Wallich, Afognak, Alaska.

ALABAMA.

Fish and Game Commissioner.

John H. Wallace, Jr., Montgomery.

ARIZONA.

Fish and Game.

T. S. Bunch, Safford.
 W. L. Pinney, Secretary, Phenix.
 E. A. Sliker, Flagstaff.

CALIFORNIA.

Fish Commissioners.

George Stone, President, San Francisco.
 F. W. VanSicklen, Alameda.
 John Birmingham, Jr., Pinole.
 Charles A. Vogelsang, Chief Deputy, San Francisco.

COLORADO.

David E. Farr, Commissioner, Denver.
 R. L. Spargur, Chief Clerk, Denver.
 W. S. Kincaide, Superintendent of Hatcheries, Denver.
 C. W. Lake, Deputy Commissioner, Denver.

CONNECTICUT.

George T. Mathewson, President, Thompsonville.
 E. Hart Geer, Secretary, Hadlyme.
 John M. Crampton, New Haven.

DELAWARE.

Game Protective Association.

A. D. Poole, President, Wilmington.
 E. G. Bradford, Jr., Secretary and Treasurer, Wilmington.

FLORIDA.

Honorary Fish Commissioner.

John Y. Detwiler, New Smyrna.

GEORGIA.

Fish Commissioner.

A. T. Dallis, LaGrange.

IDAHO.

Fish and Game Warden.

William N. Stephens, Boise.

B. T. Livingston, Chief Deputy, Boise.

ILLINOIS.

State Game Commissioner.

John A. Wheeler, Springfield

Board of Fish Commissioners.

Nat H. Cohen, President, Urbana.

S. P. Bartlett, Superintendent and Secretary, Quincy.

Henry Kleine, Chicago.

INDIANA.

Z. T. Sweeney, Commissioner, Columbus.

E. E. Earle, Chief Deputy, Indianapolis.

IOWA.

Fish and Game Warden.

George A. Lincoln, Cedar Rapids.

KANSAS.

D. W. Travis, Pratt.

MAINE.

Inland Fisheries and Game.

L. T. Carleton, Chairman, Winthrop.

J. W. Brackett, Phillips.

Edgar E. Ring, Orono.

Sea and Shore Fisheries.

James Donahue, Commissioner, Rockland.

MARYLAND.

Fisheries Commissioners.

James D. Anderson, Somerset County.

Charles F. Brooke, Montgomery County.

Game Warden.

Oregon Milton Dennis, Baltimore.

MASSACHUSETTS.

Commissioners on Fisheries and Game.

George W. Field, Chairman, Boston.

John W. Delano, Marion.

George H. Garfield, Brockton.

MICHIGAN.

Fish Commissioners.

George M. Brown, Saginaw.

Charles D. Joselyn, Detroit.

Delbert H. Power, Suttons Bay.

Game, Fish and Forestry Warden.

Charles S. Pierce, Lansing.

MINNESOTA.

Game and Fish Commissioners.

O. J. Johnson, President, Glenwood.

John H. Grill, First Vice-President, Sherburn.

C. W. Stanton, Second Vice-President, International Falls.

Robert Hannah, Secretary, Fergus Falls.

Carlos Avery, Executive Agent, Hutchinson.

S. F. Fullerton, Superintendent of Hatcheries, St. Paul.

MISSOURI.

J. C. Bassford, Mexico.

MONTANA.

State Game and Fish Warden.

William F. Scott, Helena.

NEBRASKA.

Gov. George L. Sheldon, Commissioner ex officio, Lincoln.

George L. Carter, Chief Deputy, Lincoln.

W. J. O'Brien, Superintendent of Hatcheries, Gretna.

NEW HAMPSHIRE.

Nathaniel Wentworth, Chairman, Hudson Centre.

Charles B. Clarke, Financial Agent, Concord.

Merrill Shurtleff, Secretary, Concord.

NEW JERSEY.

Benjamin P. Morris, President,	.	.	.	.	Long Branch.
David P. McClellan,	.	.	.	.	Morristown.
William A. Logue,	Bridgeton.

NEW MEXICO.

Game and Fish Warden.

W. E. Griffin,	Santa Fé.
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NEW YORK.

Forest, Fish and Game Commission.

James S. Whipple, Commissioner,	.	.	.	Salamanca.
J. Duncan Lawrence, Deputy,	.	.	.	Bloomville.
John D. Whish, Secretary,	.	.	.	Albany.

Shellfish Commissioner.

B. Frank Wood,	New York.
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NORTH DAKOTA.

District Game Warden.

W. N. Smith, District No. 1,	.	.	.	Grafton.
Olaf Bjorke, District No. 2,	.	.	.	Abercrombie.

OHIO.

Commissioners of Fish and Game.

Paul North, President,	.	.	.	.	Cleveland.
Thomas B. Paxton,	.	.	.	.	Cincinnati.
J. F. Rankin,	.	.	.	.	South Charleston.
D. W. Greene,	.	.	.	.	Dayton.
George W. McCook,	.	.	.	.	Steubenville.
George C. Blanckner, Secretary,	.	.	.	Columbus.	
J. A. Speaks, Chief Warden,	.	.	.	Columbus.	

OKLAHOMA.

Game and Fish Warden.

Eugene Watrous,	Enid.
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OREGON.

Master Fish Warden.

H. G. VanDusen,	Astoria.
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Game Warden.

R. O. Stevenson,	Forest Grove.
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PENNSYLVANIA.

Game Commissioners.

James H. Worden, President,	Harrisburg.
C. K. Sober,	Lewisburg.
William H. Myers,	.	.	.	.	Williamsport.
Charles B. Penrose,	.	.	.	.	Philadelphia.
Frank G. Harris,	.	.	.	.	Clearfield.
John M. Phillips,	.	.	.	.	Pittsburg.
Dr. Joseph B. Kalbfus, Secretary,	Harrisburg.

Department of Fisheries Commissioner.

W. E. Meehan,	Harrisburg.
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Board of Fishery Commission.

John Hamberger,	Erie.
Henry C. Cox,	Wellsboro.
Andrew R. Whitaker,	Phœnixville.
W. A. Leisenring,	.	.	.	.	Mauch Chunk.

RHODE ISLAND.

Commissioners of Inland Fisheries.

Henry T. Root, President,	.	.	.	.	Providence.
William P. Morton, Secretary,	.	.	.	.	Providence.
J. M. K. Southwick,	.	.	.	.	Newport.
Charles W. Willard,	.	.	.	.	Westerly.
Adelbert D. Roberts,	.	.	.	.	Woonsocket.
Albert Davis Mead,	.	.	.	.	Providence.
William H. Boardman,	.	.	.	.	Central Falls.

Commissioners of Shell Fisheries.

James M. Wright,	.	.	.	.	South Scituate.
Herbert M. Gardiner,	.	.	.	.	Barrington.
Phillip H. Wilbour,	.	.	.	.	Little Compton.
George W. Hoxie,	.	.	.	.	Charlestown.
James H. Northup,	.	.	.	.	Warwick.
James C. Collins, Clerk,	.	.	.	.	North Providence.

Commissioners of Birds.

C. H. Remington, Chairman,	.	.	.	.	Providence.
W. Gordon Reed, 2d,	.	.	.	.	Cowesset.
E. R. Lewis,	.	.	.	.	Westerly.
William H. Thayer,	.	.	.	.	Bristol.
A. O'D. Taylor,	.	.	.	.	Newport.

TENNESSEE.

State Warden.

Joseph H. Acklen, Nashville.

TEXAS.

Game, Fish and Oyster Commission.

R. H. Wood, Rockport.

UTAH.

H. B. Cromar, Salt Lake City.

VERMONT.

H. G. Thomas, Stowe.

VIRGINIA.

Board of Fisheries.

W. McDonald Lee, Chairman, Irvington.

S. Wilkins Matthews, Secretary, Oak Hall.

George B. Keezell, Keezletown.

Bland Massie, Tryo.

Rorer A. James, Danville.

WASHINGTON.

Fish Commissioner and Game Warden Ex Officio.

John L. Riseland, Bellingham.

WEST VIRGINIA.

Game and Fish Warden.

James H. Marcum, Huntington.

Special Deputy.

F. H. Merrick, Huntington.

WISCONSIN.

State Warden.

J. W. Stone, Barron.

Commissioners of Fisheries.

The Governor, ex officio.

Calvert Spensley, President, Mineral Point.

James J. Hogan, Vice-President, LaCrosse.

E. A. Birge, Secretary, Madison.

William J. Starr,	.	.	.	.	.	.	Eau Claire.
Henry D. Smith,	.	.	.	.	.	.	Appleton.
Jabe Alford,	.	.	.	.	.	.	Madison.
A. A. Dye,	.	.	.	.	.	.	Madison.
James Nevin, Superintendent,	Madison.

WYOMING.

State Game Warden.

D. C. Nowlin,	Lauder.
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[B.]

DISTRIBUTION OF FOOD FISH.

TROUT FRY.

Distribution of Fry from the Adams Hatchery during April and May, 1907.

APPLICANT.	Town.	Name of Brook.	Number.
George F. Sayles, . . .	Adams, . . .	Patten,	10,000
Harry J. Sheldon, . . .	Adams,	Bassett,	10,000
William P. Martin, . . .	Cheshire,	Chapman,	10,000
William F. Card,	Cheshire,	Fales,	15,000
William F. Card,	Cheshire,	Lincoln,	
William F. Card,	Cheshire,	Card,	
Walter Barber,	Savoy,	Barber's,	
F. N. Haskins,	Savoy,	Haskins,	10,000
Sanborn G. Tenney, . . .	Williamstown, . . .	Sweet and Idlewild, . . .	10,000
Daniel V. Hanson, . . .	Erving,	Jack's,	10,000
James H. O'Hara,	Greenfield,	Sheldon,	30,000
James H. O'Hara,	Greenfield,	Potter,	
James H. O'Hara,	Greenfield,	Phillips,	
James H. O'Hara,	Leyden,	Barton,	
James H. O'Hara,	Leyden,	Glen, east,	10,000
James H. O'Hara,	Leyden,	Glen, west,	
Charles C. Stearns, . . .	Northfield,	Miller and Warwick's, . . .	
H. H. Ramsey,	New Salem,	Swift River,	
James H. Krum,	North Adams,	Tunnel,	20,000
James H. Krum,	North Adams,	Hudson,	
James H. Krum,	North Adams,	North Branch,	
James M. Burns,	Lanesborough,	Holly,	
James M. Burns,	Lanesborough,	Wells,	10,000
Sigmund Klaiber,	Gill,	Clark,	
Sigmund Klaiber,	Bernardston,	Fall River,	
Sigmund Klaiber,	Gill,	Dry,	
H. A. Barton,	- - -	- - -	10,000
H. A. Barton,	- - -	- - -	-
W. H. Sherrill,	Richmond,	Furnace,	5,000
			200,000

Fry distributed from the Hadley Hatchery during April and May, 1907.

W. S. Gabb,	Cummington,	Nipping and Mitchell, . . .	20,000
W. A. Smith,	Goshen,	Highland,	5,000
F. E. Hawks,	Goshen,	Packard,	5,000
M. W. Smith,	Goshen,	Rogers,	5,000
John Doherty,	Goshen,	Hampshire,	5,000
C. F. Bates,	Worthington,	Stevens,	5,000
Frank Burr,	Worthington,	Ringville,	5,000
Charles Brooks,	Worthington,	Center,	5,000
Charles A. Kilbourn, . . .	Worthington,	Corner,	5,000
Clarence K. Bates,	Worthington,	Sampson,	5,000
Horace S. Cole,	Worthington,	Hegen Stream,	5,000
William H. Robert,	Chicopee Falls,	Poor,	10,000
Francis H. Graves,	Chicopee,	Willimansett,	10,000
J. R. Beaudoin,	Chicopee Falls,	Cooley,	10,000
Walter A. Sheldon,	Westhampton,	Roberts Meadow,	5,000
Charles H. Sawyer,	Sunderland,	Welsh,	5,000

Fry distributed from the Hadley Hatchery, etc. — Concluded.

APPLICANT.	Town.	Name of Brook.	Number.
Peter McHugh, . . .	Hatfield, . . .	Running Gutter, . . .	5,000
Thomas F. Ahearn, . . .	Sunderland, . . .	Ahern, . . .	5,000
Frank Shaughnessy, . . .	Northampton, . . .	Parsons, . . .	5,000
Edward Miller, . . .	Northampton, . . .	Roberts Meadow, . . .	5,000
George L. Harris, . . .	Sunderland, . . .	Welsh, . . .	5,000
Henry L. Pierce, . . .	Barre, . . .	Prince River, . . .	10,000
Joseph F. Barrett, . . .	Barre, . . .	Burnshirt River, . . .	10,000
A. P. Morin, . . .	North Brookfield, . . .	Webb, . . .	20,000
A. P. Morin, . . .	North Brookfield, . . .	Snow, . . .	
A. P. Morin, . . .	North Brookfield, . . .	Mad, . . .	
A. P. Morin, . . .	North Brookfield, . . .	Bigelow, . . .	
A. P. Morin, . . .	North Brookfield, . . .	Town Farm, . . .	
			175,000

Fry distributed from the Sutton Hatchery during April and May, 1907.

Edward G. Clark, . . .	Westfield, . . .	{ Powder Mill, . . . Munn's, . . . }	60,000
Alfred Read, . . .			
F. F. Shepard, . . .			
John M. Sauter, . . .			
R. K. Andrews, . . .			
Leon H. Bowers, . . .			
W. G. Bailey, . . .			
R. L. Soper, . . .			
Ward Rees, . . .			
C. L. Houghton, . . .			
Charles F. Bowers, . . .	Worcester, . . .	{ Barber's, . . . Clay, . . . Streeter, . . . Prentice, . . . Burt, . . . Brigham, . . . Poor Farm, . . . Carrol and Bummit, . . . Poor Farm, . . . Poor Farm, . . .	15,000
C. L. Allen, . . .			
John L. Houde, . . .			
John S. Hubbard, . . .			
W. E. Johnson, . . .			
H. W. Barnes, . . .			
W. L. Taft, . . .			
George L. Gill, . . .			
Elmer A. Macker, . . .			
W. F. Durgin, . . .			
Fred S. Casavant, . . .	Mendon, . . .	{ Poor Farm, . . . Poor Farm, . . . Poor Farm, . . . Bailey, . . . Wilder, . . . Bailey, . . . Cook, . . . Bailey, . . . Cooper, . . . Brown, . . .	10,000
D. H. Gates, . . .			
F. A. Gravin, . . .			
C. F. Morse, . . .			
J. G. Britton, . . .			
L. F. Earle, . . .			
A. W. Pratt, . . .			
Henry E. Dean, . . .			
H. G. Howard, . . .			
Charles B. Adams, . . .			
Leominster Sports- men's Association, . . .	Leominster, . . .	{ Lyne's, Monoosnock, Wee- keepee, . . . Slate Mill, . . . — . . . — . . . Crow Hill, . . . Dean, . . . Hatchet, . . . McKinstry, . . . Ellinwood, . . . — . . .	25,000
Arthur G. Chickering, . . .			
Charles S. Dodge, . . .			
Harry C. Dodge, . . .			
H. Courtemanche, . . .			
A. E. Whittaker, . . .			
Harry Wardle, . . .			
J. F. Merrill, . . .			
J. S. Harwood, . . .			
T. B. Stevenson, . . .			
C. E. Bill, . . .	Sutton, . . .	{ Tucker, . . . White, . . .	5,000
	West Brookfield, . . .		5,000
			275,000

Fry distributed from the Winchester Hatchery during April and May, 1907.

John F. Hill, . . .	Burlington, . . .	Skelton, . . .	5,000
Dr. A. S. Lamb, . . .	Burlington, . . .	Carter, . . .	5,000
Harry N. Rogers, . . .	Holliston, . . .	Dopping, . . .	5,000
William E. Badger, . . .	Tewksbury, . . .	Prospect Hill, . . .	5,000

Fry distributed from the Winchester Hatchery, etc. — Concluded.

APPLICANT.	Town.	Name of Brook.	Number.
Southwell Farrington, .	Lowell, . . .	Meadow, . . .	5,000
Waldo Spaulding, .	Pepperell, . . .	Sucker, . . .	5,000
John A. Roberts, .	Reading, . . .	Mink, . . .	5,000
C. F. Cowdry, .	Townsend, . . .	Trout, . . .	5,000
T. H. Varnum, .	Tyngsborough, . . .	Flints, . . .	5,000
Henri E. Richardson, .	Westford, . . .	Snake Meadow, . . .	5,000
Edward N. Eames, .	— . . .	— . . .	5,000
John S. Cooney, .	Rockport, . . .	Stoney, . . .	5,000
H. Gee, .	Rockport, . . .	Wine, . . .	5,000
Clyde C. Hunt, .	Medway, . . .	Hodges, . . .	5,000
Edgar L. Freeman, .	Medway, . . .	Sawmill, . . .	5,000
A. D. Wheeler, .	Milton, . . .	Pine Tree, . . .	5,000
Tobias H. Burke, .	Quincy, . . .	Blue Hill River, . . .	5,000
John J. Kennedy, .	Stoughton, . . .	Dead Meadow, . . .	5,000
G. Fred Howard, .	Berkley, . . .	Wild, . . .	5,000
Ernest L. White, .	Mansfield, . . .	Lowland, . . .	5,000
Fred Chadderton, .	Mansfield, . . .	Willow, . . .	5,000
Wayne M. Freeman, .	Lakeville, . . .	Hathaway, . . .	5,000
Eugene E. Wood, .	Woburn, . . .	Beaver, . . .	5,000
Lewis A. White, .	Woburn, . . .	Carter's, . . .	5,000
Charlie A. Jones, .	Woburn, . . .	Shaker Glen, . . .	5,000
L. D. McDermott, .	Burlington, . . .	Buckminster, . . .	5,000
C. E. Taylor, .	— . . .	— . . .	5,000
William J. Hammond, .	Woburn, . . .	Cutler's, . . .	5,000
George V. Lewis, .	Woburn, . . .	Keyes, . . .	5,000
Charles W. Ames, .	Woburn, . . .	Boutwell Place, . . .	5,000
Frank W. Ames, .	Woburn, . . .	McManus, . . .	5,000
John H. Sweetser, .	Woburn, . . .	Hall's, . . .	5,000
Charles S. Baker, .	Falmouth, . . .	Childs' River, . . .	5,000
Jere J. Donovan, .	Randolph, . . .	Blue Hill River, . . .	5,000
S. J. Bigelow, .	North Chelmsford, . . .	Swain's, . . .	5,000
George W. Alcott, .	Chelmsford, . . .	Black, . . .	5,000
S. J. Anthony, .	Carlisle, . . .	Page's, . . .	5,000
Isaac A. Ferrin, .	Peabody, . . .	Allen's, . . .	5,000
George Manning, .	Peabody, . . .	Bodge's, . . .	5,000
James M. Cutting, .	Braintree, . . .	Arnold, . . .	5,000
George H. White, .	South Braintree, . . .	Cold Spring, . . .	5,000
			205,000

Fingerling Trout Plants during Fall of 1907.

Henry B. Burdick, .	Adams, . . .	Tophet, . . .	500
William F. Card, .	Cheshire, . . .	Fales, Card, . . .	500
H. O. Hicks, .	Adams, . . .	Dean, . . .	500
Thomas H. Hughes, .	Adams, . . .	Hall, . . .	500
Frank W. Rice, .	Lanesborough, . . .	Town, . . .	1,000
William H. Newton, .	Lanesborough, . . .	Wells, . . .	500
James M. Burns, .	Pittsfield, . . .	Sackett, Yokum, . . .	500
William T. Crittenden, .	— . . .	— . . .	250
H. A. Barton, .	Dalton, . . .	Brown, Dalton, . . .	500
A. Silvernail, .	State Line, . . .	Baldwin, . . .	250
W. H. Sherrill, .	— . . .	— . . .	250
G. W. Tucker, .	South Egremont, .	South Egremont, .	750
Henry S. Manley, .			
G. D. Gregory, .			
James H. O'Hara, .			
James H. O'Hara, .	Leyden, . . .	Glen, east and west, . . .	1,000
Sigmond Klaiber, .	Greenfield, . . .	Stickney, . . .	
Sigmond Klaiber, .	Guil, . . .	Dry, . . .	750
F. E. Briggs, .	Bernardston, . . .	Fall River, . . .	
C. L. Crafts, .	Montague, . . .	Sawmill, . . .	250
A. S. Hunt, .	Whately, . . .	Roaring, . . .	250
C. A. Hinds, .	New Salem, . . .	Swift River, . . .	1,000
H. H. Ramsey, .			
Albert F. Tolman, .			
H. H. Chamberlain, .			
John W. Haigis, .	Northfield, . . .	Miller, . . .	250
Fred E. Field, .	Northfield, . . .	Warwick, . . .	250
P. B. Hasbrouck, .	Montague, . . .	Pond, . . .	250
	Montague, . . .	Cold, . . .	250
	Prescott, . . .	Swift River, west, . . .	250

Fingerling Trout Plants during Fall of 1907 — Continued.

APPLICANT.	Town.	Name of Brook.	Number.
A. T. Mitten, . . .	Prescott, . . .	Swift River, east, . . .	250
John Doherty, . . .	Goshen, . . .	Hampshire, . . .	250
W. A. Smith, . . .	Goshen, . . .	Highland, . . .	250
F. E. Hawks, . . .	Goshen, . . .	Packard, . . .	250
M. W. Smith, . . .	Goshen, . . .	Rogers, . . .	250
George L. Harris, . . .	— — —	— — —	—
E. C. Rice, . . .	Northampton, . . .	Walsh, . . .	1,000
W. A. Sheldon, . . .	Westhampton, . . .	Westhampton, . . .	
G. J. Thayer, . . .	Northampton, . . .	Parsons, . . .	
Charles H. Sawyer, . . .	Hatfield, . . .	Running Gutter, . . .	
Thomas F. Ahern, . . .	Sunderland, . . .	Ahern, . . .	
Edward Miller, . . .	Northampton, . . .	Roberts Meadow, . . .	
George Hoffman, . . .	South Hadley, . . .	Buttery, . . .	1,000
Fred Wester, . . .			
F. M. Smith, . . .			
George M. Selfridge, . . .			
W. C. Cowan, . . .	Holyoke, . . .	Broad, . . .	250
Frank Roberts, . . .			
Ira J. Humes, . . .			
Justin W. Keith, . . .			
John L. Brewer, . . .			
Wells G. Bisbee, . . .			
C. M. Pettingill, . . .	Williamsburg, . . .	Ashfield Stream, . . .	500
L. W. Pettingill, . . .			
Jesse M. Howes, . . .			
Henry H. Hitchcock, . . .			
Milton S. Howes, . . .			
H. E. Drake, . . .			
W. S. Gabb, . . .	Cummington, {	Nipping, . . .	1,000
T. P. Tower, . . .			
William H. Robert, . . .			
J. R. Beaudoin, . . .			
Francis H. Graves, . . .			
John M. Sauter, . . .			
Edward G. Clark, . . .	Chicopee Falls, . . .	Cooley, . . .	250
Ward Rees, . . .			
R. L. Soper, . . .			
C. L. Haughton, . . .			
R. K. Andrews, . . .			
Leon H. Bowers, . . .			
Alfred Read, . . .	Chicopee, . . .	Willimansett, . . .	250
Charles F. Bowers, . . .			
W. G. Bailey, . . .			
F. F. Shepard, . . .			
A. D. Norcross, . . .			
John F. Hayden, . . .			
George W. Bautell, . . .	Palmer, . . .	Swift River, . . .	250
J. S. Harwood, . . .			
Myron R. Goddard, . . .			
Levi G. McKnight, . . .			
F. A. Gravin, . . .			
D. H. Gates, . . .			
S. A. Waite, . . .	Athol, . . .	Riceville, . . .	500
F. J. Pierce, . . .			
J. S. Ames, . . .			
Edric H. Coleman, . . .			
Lewis A. Hartwell, . . .			
Charles N. Dyer, . . .			
Herbert L. Curtis, . . .	Athol, . . .	— — —	250
A. W. Pratt, . . .			
B. H. Webster, . . .			
E. A. Woodward, . . .			
G. Frank Balcom, . . .			
J. E. Stuart, . . .			
J. W. Hunting, . . .	Westminster, . . .	Bigelow and Tophet, . . .	750
G. L. Dawley, . . .			
F. L. Hager, . . .			
F. J. Day, . . .			
Charles N. Merriam, . . .			
J. D. Mason, . . .			
Nelson H. Blanchard, . . .	Winchendon, . . .	Beaman, . . .	1,000
F. A. Anderson, . . .			
Elmer A. Macker, . . .			
Leominster Sports-			
men's Association, . . .			
	Grafton, . . .	Cold Spring, . . .	250
	North Grafton, . . .	Bummit and Carroll, . . .	250
	Leominster, . . .	Wekepeke and Stewart, . . .	1,000

Fingerling Trout Plants during Fall of 1907 — Continued.

APPLICANT.	Town.	Name of Brook.	Number.
H. E. Brown,	Prescott,	Brown,	250
H. G. Howard,	Ashburnham,	Cooper,	250
A. G. Chickering,	Lancaster,	Cemetery,	250
Andrew F. Hall,	Southbridge,	McKinstry,	250
P. S. Callahan,	Sturbridge,	Hinman and Bemis,	250
Charles B. Adams,	Webster,	Potash and Freeman,	250
T. B. Stevenson,	— — — — —	— — — — —	250
G. A. Keith,	— — — — —	— — — — —	250
George E. Whitehead,	— — — — —	— — — — —	250
Rufus B. Dodge,	— — — — —	— — — — —	250
Hiram J. Parent,	Holden,	Fessenden,	250
Thomas H. Davis,	Holden,	Parsons,	250
William Wadsworth,	Holden,	Holden,	250
Charles S. Dodge,	— — — — —	— — — — —	250
Henry E. Dean,	— — — — —	— — — — —	250
C. L. Allen,	Worcester,	Barber,	250
W. E. Johnson,	— — — — —	— — — — —	500
C. V. Dudley,	— — — — —	— — — — —	500
George L. Gill,	— — — — —	— — — — —	500
W. L. Taft,	Northbridge,	Northbridge,	500
C. E. Bill,	West Brookfield,	Taney,	1,000
Charles H. Clark,	West Brookfield,	Allen,	
J. S. Donovan,	West Brookfield,	Barrett,	
J. B. Haskins,	West Brookfield,	White,	
J. Frank Stone,	East Brookfield,	Great,	250
A. P. Morin,	North Brookfield,	Mad, Poor Farm,	500
A. P. Morin,	North Brookfield,	Bigelow,	
M. C. Capen,	Spencer,	Meadow,	250
C. E. Comins,	— — — — —	— — — — —	250
James B. Hodder,	Blackstone,	Fox,	250
Frank Stockwell,	— — — — —	Cooper,	250
Richard L. Everit,	Wellesley,	Cold Spring,	250
W. F. Durgin,	Mendon,	Muddy, Upton,	500
W. F. Durgin,	Mendon,	Taft,	
Henry E. Dean,	Barre Plains,	Pratt,	250
Cameron E. Wood,	Barre,	Pratt,	250
Smith Finney,	— — — — —	— — — — —	500
Harry L. Shedd,	Tewksbury,	Felker,	250
Southwell Farrington,	Lowell,	Long Meadow,	250
LeRoy J. Parkhurst,	Chelmsford,	Stevens and Blind,	250
Andrew Garbutt,	Holliston,	Jar,	250
Oliver K. Pierce,	Ayer,	Beaver,	250
John F. Tune,	East Pepperell,	Blood,	250
M. E. S. Clemons,	Wilmington,	Lubber,	250
Charles N. Hargraves,	Framingham,	Edgell and Rattlesnake,	250
James A. Jones,	Stoneham,	Sweetwater,	250
H. E. Cowdry,	Townsend,	Pearl Hill,	500
William P. Wharton,	Groton,	Baddacook,	500
H. P. Andrews,	Hudson,	Hog,	250
Frank B. Twitchell,	— — — — —	— — — — —	—
William F. Walsh,	Framingham,	Brackett,	750
Charles W. Curtis,	— — — — —	— — — — —	—
H. W. Eager,	— — — — —	— — — — —	—
Walter P. Frye,	Marlborough,	Fort Meadow,	1,000
E. Irving Muse,	— — — — —	Flagg,	
John M. Carpenter,	— — — — —	Junction,	
B. Frank Smith,	Andover,	Baker, Rogers,	250
L. H. Bartlett,	Boxford,	Trout,	250
Stephen H. Sinclair,	Middleton,	Poor's,	250
Isaac A. Ferren,	Middleton,	Beach,	250
George Manning,	Middleton,	Beach,	250
David G. Webster,	Peabody,	Norris,	250
Edgar L. Freeman,	Medway,	Gurney's,	250
Clyde C. Hunt,	Rockville,	Hogg,	250
John Clancy,	Medway,	Railroad,	250
A. D. Wheeler,	— — — — —	— — — — —	250
Charles C. Peck,	Wrentham,	Rabbit Hill,	250
Fred H. Miller,	Hingham,	Plymouth and Beechwood,	1,000
Tobias H. Burke,	Quincy,	Monatiquot,	1,000
Seth Damon,	Weymouth,	Old Swamp,	1,000
George H. White,	South Braintree,	Cold Spring,	500
Frank A. Chamberlain,	South Braintree,	Monatiquot,	500
John J. Kennedy,	Stoughton,	Dead Meadow,	1,000
H. M. Plummer,	Sharon,	Devil's,	1,000
J. Herbert Tower,	Rockland,	Plyer and Molly,	1,000

Fingerling Trout Plants during Fall of 1907 — Concluded.

APPLICANT.	Town.	Name of Brook.	Number.
T. E. Reilly, .	Randolph, . .	Long,	1,500
M. E. Leahy, .			
W. J. Cahill, .			
W. F. Barrett, .	Randolph, . .	Meadow,	500
Charles S. Baker, .	Falmouth, . .	Childs' River,	1,000
Taunton Rod & Gun Club, .	Lakeville, . .	Holloway,	1,000
Allen P. Hoad, .	Lakeville, . .	Poquoy,	1,000
W. E. Woodward, .	Taunton, . .	Woodward,	1,000
Albert T. Hodges, .	Mansfield, . .	Town Farm,	500
George B. Treen, .	Mansfield, . .	Hersey,	500
Norman Barstow, .	New Bedford, .	Pashamansett,	1,000
Simeon C. Keith, .	East Bridgewater, .	Katy's Spring,	1,000
L. C. Humphrey, .	Rochester, . .	Doggett's,	1,000
			58,000

PONDS STOCKED AND CLOSED IN ACCORDANCE WITH CHAPTER 91, SECTION 19, REVISED LAWS, AS AMENDED BY CHAPTER 274, ACTS OF 1903, AND FURTHER AMENDED BY CHAPTER 306, ACTS OF 1907.

NAME OF POND.	TOWN.	Rain-bow.	Brown Trout.	Land-locked Salmon.	Pike Perch.
Baddacook,	Groton,	—	1,000	—	—
Stiles,	Boxford,	—	1,000	—	—
Little Chauncy,	Northborough,	—	1,000	—	—
Pleasant Lake,	Harwich,	500	—	500	—
Queen Lake,	Phillipston,	500	—	500	—
Massapoag Lake,	Sharon,	500	—	500	20
Monponsett Lake,	Halifax,	—	—	1,000	—
Quannapowitt Lake,	Wakefield,	—	1,000	—	—
Goose,	Chatham,	—	500	—	—
Scargo Lake,	Dennis,	—	500	—	—
Prospect,	Taunton,	—	1,000	—	—
Long,	Royalston,	—	1,000	—	—
Horse,	Yarmouth,	500	—	—	—
Greenough,	Yarmouth,	—	—	500	—
Great Herring,	Plymouth,	—	500	—	—
Little Herring,	Plymouth,	—	500	—	—
		2,000	8,000	3,000	20

PONDS RESTOCKED DURING THE YEAR 1907.

NAME OF POND.	TOWN.	Pike Perch Eggs.
Quinsigamond Lake,	Worcester,	2,000,000
Chaubunagungamaug Lake,	Webster,	1,000,000
		3,000,000

[C.]

DISTRIBUTION OF PHEASANTS.

APPLICANT.	Town.	Number.
Edney A. Lapham,	New Bedford,	7
John I. Bryant,	Fairhaven,	7
Charles G. Buffington,	Fall River,	7
Taunton Rod and Gun Club,	Taunton,	7
William D. Mandell,	Cohasset,	7
Edgar W. Lovell,	Santuit,	7
Thomas F. Horrigan,	Framingham,	7
William H. Burlen,	Sherborn,	7
Everett Morey,	Ashland,	7
Adelbert D. Thayer,	Franklin,	7
W. F. Durgin,	Hopedale,	7
Charles A. Kimball,	Littleton,	7
Henry M. Green,	North Wilbraham,	7
John W. Tyler,	Warren,	7
A. P. Morin,	North Brookfield,	7
Dana Malone,	Greenfield,	7
James H. O'Hara,	Greenfield,	7
Sanborn G. Tenney,	Williamstown,	7
William J. Potter,	Northborough,	8
T. B. Stevenson,	Manchaug,	8
Henrie C. Fay,	Royalston,	8
H. Courtemanche,	Southbridge,	8
Frank Stockwell,	Auburn,	8
Charles B. Adams,	Webster,	8
J. F. Despeaux,	West Upton,	8
Charles H. Goodell,	Worcester,	8
Elmer A. Macker,	North Grafton,	7
James M. Cutting,	South Braintree,	7
W. H. Reynolds,	Braintree,	7
G. M. Shaw,	South Weymouth,	7
Sidney T. Nelson,	Lakeville,	7
Henry O. Whiting,	Plymouth,	7
Herbert E. Guy,	Brockton,	7
Charles H. Shriver,	Dedham,	7
Henry M. Knowles,	Dartmouth,	7
Albert W. Lewis,	Westport Factory,	7
Thomas Rice,	Fall River,	7
M. P. Clough,	Saugus,	7
Frank A. Patch,	Littleton,	14
Smith Finney,	South Acton,	14
Total,		302

[D.]

DISTRIBUTION OF BELGIAN HARES.

APPLICANT.	Town.	Number.
Charles B. Adams,	Webster,	6
W. F. Durgin,	Hopedale,	6
Merrill A. Stebbins,	Palmer,	6
Henry G. Trimble,	Monson,	6
Arthur Hardy,	Lowell,	6
George A. Dudley,	South Methuen,	6
Dominic McGovern,	Lawrence,	6
Thomas Croswell,	North Reading,	6
Charles A. Loring,	Reading,	6
Total, . . . .	. . . .	54

The rearing and distribution of Belgian hares has been discontinued.

[E.]

ARRESTS AND CONVICTIONS.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Salvatore Parisi,	Boston, .	Taking shellfish in violation of § 114, c. 91, R. L., also c. 285, Acts of 1907, .	Convicted,	—	Filed.
Giacomo Luciedo,	Boston, .		Convicted,	—	Filed.
Nicola Parisi,	Boston, .		Convicted,	—	Filed.
Giacinto Lovosco,	Boston, .		Convicted,	—	Filed.
Joseph Orlando,	Boston, .		Convicted,	—	Filed.
Salviato Lovosco,	Boston, .		Convicted,	—	Filed.
Ambroico Orlando,	Boston, .		Convicted,	—	Filed.
Joseph Aiello,	Boston, .		Convicted,	—	Filed.
Alexander Soucy,	New Bedford,		Convicted,	\$10 00	
Edward Landry,	New Bedford,		Convicted,	10 00	
Stephen Gaughan,	New Bedford,		Convicted,	10 00	
Edward Bergeron,	New Bedford,		Convicted,	10 00	
Boora Jyisefie,	New Bedford,		Convicted,	10 00	
Frank Banga,	New Bedford,		Convicted,	10 00	
Antone Souza,	New Bedford,		Convicted,	5 00	
George H. Broadbent,	Quincy, .		Convicted,	5 00	
John Washburn,	Quincy, .		Convicted,	5 00	
Thomas Hayes,	Quincy, .		Convicted,	5 00	
Robert J. Wilkinson,	Quincy, .		Convicted,	5 00	
James E. Packard,	Quincy, .		Convicted,	5 00	
George E. Coleman,	Quincy, .		Convicted,	5 00	
Joseph Kuhns,	Quincy, .		Convicted,	5 00	
Richard E. Worrell,	Dorchester,		Convicted,	—	
Joseph Mack,	Dorchester,		Convicted,	—	
John Sylvia,	New Bedford,		Convicted,	15 00	Filed.
William Coult,	Roxbury,		Convicted,	10 00	

Ernest K. Rogers,	Somerville,	Convicted,	10 00	
Clifford A. Clark,	Quincy,	Convicted,	10 00	
Patrick Larnier,	New Bedford,	Convicted,	10 00	
Charles F. Harrington,	Fairhaven,	Convicted,	10 00	
Joseph Golden,	New Bedford,	Convicted,	10 00	
Adelaid Breton,	New Bedford,	Convicted,	10 00	
Boora Iyenfa,	New Bedford,	Convicted,	10 00	
Frank Banza,	New Bedford,	Convicted,	10 00	
Dennis Durrant, Jr.,	New Bedford,	Convicted,	10 00	
Arthur Durrant,	New Bedford,	Convicted,	10 00	
Michael Casey,	New Bedford,	Convicted,	10 00	
Michael Groteau,	New Bedford,	Convicted,	10 00	
John Casey,	New Bedford,	Discharged,	—	
James H. Ellis,	Fairhaven,	—	—	Defaulted; warrant out.
Joseph Sanborn,	New Bedford,	Convicted,	10 00	
Joseph Hubut,	Fairhaven,	Convicted,	10 00	
Louis LeBlanc,	New Bedford,	Convicted,	10 00	
Joseph Oullette,	New Bedford,	Convicted,	10 00	
Maxim Gerard,	New Bedford,	Convicted,	10 00	
Zeph Godreau,	New Bedford,	Convicted,	10 00	
Louis Rivino,	New Bedford,	—	—	Defaulted; warrant out.
Glovis Gagnon,	New Bedford,	Convicted,	50 00	
Alexander Soucy,	New Bedford,	Convicted,	15 00	
Manuel Cabral,	New Bedford,	Convicted,	15 00	
Reside DeMille,	New Bedford,	Convicted,	15 00	
Alfred Turgeon,	New Bedford,	Convicted,	10 00	
Leo Doucette,	New Bedford,	Convicted,	15 00	
Manuel S. Mederious,	New Bedford,	Convicted,	15 00	
Joseph Marshall,	New Bedford,	Convicted,	15 00	
Antone C. Capen,	New Bedford,	Convicted,	15 00	
Joseph M. Alma,	New Bedford,	Convicted,	15 00	
Richard Fisher,	New Bedford,	Convicted,	15 00	
Howard Fisher,	New Bedford,	Convicted,	15 00	
Thomas Smith,	New Bedford,	Convicted,	15 00	
Manuel Moniz,	New Bedford,	Convicted,	50 00	Second offence.
Agilo Rebella,	New Bedford,	Convicted,	15 00	
John Souza,	New Bedford,	Convicted,	15 00	
Joseph Marshall,	Fairhaven,	Convicted,	15 00	
Thomas D. Brownell,	Fairhaven,	—	—	On probation.
Isaac A. Thurston,	New Bedford,	Convicted,	15 00	Defaulted.
Aldene Florence,	New Bedford,	—	—	
Alfred Aslin,	New Bedford,	Convicted,	15 00	
John Santo,	New Bedford,	Convicted,	15 00	
Starle Nofe,	New Bedford,	Convicted,	15 00	

Taking shellfish in violation of § 114, c.
91, R. L., also c. 285, Acts of 1907.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
James Nofe,	New Bedford,	Taking shellfish in violation of § 114, c. 91, R. L., also c. 285, Acts of 1907,	Convicted,	\$15 00	Not prossed. Second offence.
John Mederious,	New Bedford,		Convicted,	15 00	
John Mederious, 2d,	New Bedford,		Convicted,	15 00	
Antone B. Cate,	New Bedford,		Convicted,	15 00	
Louis Townsend,	Fairhaven,		Discharged,	—	
Joseph LaPoint,	New Bedford,		Convicted,	50 00	
Thomas C. Starkey,	New Bedford,		Convicted,	10 00	
Charles S. Dunkley, Jr.,	New Bedford,		Convicted,	10 00	
Perry H. Hoyle,	Freetown,		Convicted,	10 00	
Henry Cassidy,	Holyoke,		Convicted,	20 00	
Clinton L. Weatherbee,	Southwick,	Fishing in closed ponds in violation of § 19, c. 91, R. L., as amended by c. 274, Acts of 1903, and further amended by c. 306, Acts of 1907,	Convicted,	20 00	Filed on payment of costs.
John Pyne,	Southwick,		Convicted,	—	
Wingett Xavier,	Lowell,		Convicted,	20 00	
Alexander McKenzie,	Lowell,		Convicted,	—	
Albert E. M. Ballou,	Attleborough,		Discharged,	—	
Russell Munn,	North Adams,		Convicted,	3 00	
Andrew Drey,	North Adams,		Convicted,	3 00	
Chas. S. Woolcott,	Springfield,		Convicted,	5 00	
William H. Eccleston,	Southbridge,		Convicted,	5 00	
John Day,	Sturbridge,		Convicted,	5 00	
Leslie Stevens,	Palmer,	Hunting on Lord's Day in violation of § 1, c. 92, R. L., as amended by c. 176, Acts of 1904,	Discharged,	—	Filed; paid costs, \$3. Filed; paid costs, \$3.
Clarence N. Mellen,	Palmer,		Discharged,	—	
Henry Bearegard,	Palmer,		Convicted,	5 00	
Augustus Goodness,	Gardner,		Convicted,	5 00	
Charles Thiebault,	Gardner,		Convicted,	5 00	
Edward White,	East Longmeadow,		Convicted,	10 00	
Ernest Lenburg,	Maynard,		Discharged,	—	
Orlow Barnes,	Great Barrington,		Convicted,	—	
Harry Decker,	Alford,		Convicted,	—	
C. H. Richardson, Jr.,	Newburyport,		Convicted,	10 00	
Lawrence Noyes,	Newburyport,	Hunting on Lord's Day in violation of § 1, c. 92, R. L., as amended by c. 176, Acts of 1904,	Convicted,	10 00	Filed.
Sidney Drownie,	Newburyport,		Convicted,	10 00	
Joseph Kadra,	Ashland,		Convicted,	—	
John Albrini,	Ashland,		Convicted,	10 00	
Bonfilio Albrini,	Ashland,		Convicted,	10 00	
Samuel Chapman,	Mansfield,		Convicted,	10 00	
Alexander Lowell,	Lowell,	Hunting on Lord's Day in violation of § 1, c. 92, R. L., as amended by c. 176, Acts of 1904,	Discharged,	—	Filed.
Stephen Thompson,	Lowell,		Convicted,	10 00	

George Melle,	New York,	Convicted,	2 00	Also alien without license.
Raffaele Antonucci,	Brainfree,	Convicted,	10 00	
John Loretta,	Norwood,	Convicted,	10 00	
Thomas Nutley,	Boston,	Convicted,	10 00	
Fortunati Macroello,	Great Barrington,	Convicted,	10 00	Also alien without license.
Giuseppe Passalacqua,	Boston,	Convicted,	5 00	
Nicholas Boggani,	Boston,	Convicted,	5 00	
Charles Stone,	Ashland,	Convicted,	5 00	
Germano Gallerani,	Hopkinton,	Convicted,	10 00	
Sylvester Smith,	Plainville,	Discharged,	—	
Henry Smith,	Plainville,	Discharged,	—	
Edmund Pruex,	Beverly,	Convicted,	15 00	
Medric Trembly,	Salem,	Convicted,	15 00	
Louis Letarte,	Salem,	Convicted,	15 00	
Edward J. Cummings,	Salem,	Convicted,	15 00	
John H. Fallon,	Salem,	Convicted,	10 00	
James Archibald,	Salem,	Convicted,	10 00	
Ira C. Goff,	Campello,	Convicted,	10 00	
William Barry,	Campello,	Convicted,	10 00	
Fred Hathaway,	Rehoboth,	Convicted,	10 00	
G. Howard Dean,	Holyoke,	Discharged,	—	
Lynford P. Fowles,	Holyoke,	Discharged,	—	
Henry Davis,	Holyoke,	Discharged,	—	
William Davis,	Holyoke,	Discharged,	—	
John Steele,	Hatfield,	Convicted,	10 00	
Hugo Zimmer,	Holyoke,	Convicted,	10 00	
Joseph Shimaski,	Granby,	Convicted,	12 00	
George A. Blashfield,	Warren,	Convicted,	10 00	
John Bromley,	Belchertown,	Convicted,	10 00	
Ivon Damon,	Ashby,	Discharged,	—	To avoid a criminal record.
Fred E. Mann,	Weymouth,	Convicted,	10 00	
Nelson D. Gladwin,	Weymouth,	Convicted,	10 00	
Charles Johnson,	Boston,	Discharged,	—	Convicted and then not pressed.
John A. Breding,	Greenfield,	Convicted,	10 00	
Abel C. Carley,	Lanesborough,	Convicted,	10 00	
Emil Jordan,	Pittsfield,	Convicted,	10 00	
Louis J. Marcel,	Pittsfield,	Convicted,	10 00	
Joseph P. Crook,	Rockland,	Discharged,	—	Out of jurisdiction.
Edward Arnold,	Marshfield,	Discharged,	—	Out of jurisdiction.
William Damon,	Marshfield,	Discharged,	—	Also illegal possession of game.
William D. Ewell,	Marshfield,	Discharged,	—	
Theodore H. Forgeon,	Plymouth,	Convicted,	10 00	

Hunting on Lord's Day in violation of
§ 1, c. 92, R. L., as amended by c. 176,
Acts of 1904,

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE E. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Leo White.	Plymouth.	Hunting on Lord's Day in violation of § 1, c. 92, R. L., as amended by c. 176, Acts of 1904.	Discharged.	—	
Henry Raymond.	Plymouth.		Discharged.	—	
Winnie Seeley.	Williamstown.		Convicted.	\$10 00	Filed.
Charles Barber.	Erving.		Convicted.	10 00	
Chasler Andrews.	Erving.		Convicted.	—	Filed.
Jacob Faustini.	North Adams.		Convicted.	10 00	
George Miami.	Sudbury.		Convicted.	10 00	
Charles Lugero.	Boston.		Convicted.	10 00	
Nathan W. Smith.	Millers Falls.		Convicted.	10 00	
Farfield Porter.	Brookton.		Convicted.	10 00	
Alvin Newberry.	Brookton.	Hunting without license in violation of c. 317, Acts of 1905.	Convicted.	10 00	
Charles Brennan.	Swansea.		Convicted.	20 00	
Norman Barnstow.	New Bedford.		Discharged.	—	
John O'Neill.	New Bedford.		Convicted.	10 00	
Charles E. Schrader.	Sandwich.		Convicted.	10 00	
John Martinakis.	Northampton.		Convicted.	15 00	
William Yowajszis.	Northampton.		Convicted.	15 00	
Villana Mattes.	Westfield.		Convicted.	10 00	
Giuseppe Pontirini.	Framingham.		Discharged.	—	See shooting song birds. Filed; Sunday hunting.
Samuel Chapman.	Mansfield.		Convicted.	—	See Sunday hunting.
Henry Hartman.	Norton.	Hunting without license in violation of c. 317, Acts of 1905.	Convicted.	10 00	
George Melle.	New York.		Convicted.	3 20	
John Schwisik.	Taunton.		Convicted.	10 00	
Joseph Voshe.	Taunton.		Convicted.	10 00	
Raffaele Antonucci.	Braintree.		Convicted.	10 00	
John Loretta.	Norwood.		Convicted.	10 00	
Joseph Enos.	New Bedford.		Convicted.	10 00	
Enrico Delphino.	Wilbraham.		Convicted.	10 00	
Mino Carmio.	Wilbraham.		Convicted.	—	Filed. Filed.
Giuseppe Garriglio.	Wilbraham.		Convicted.	—	
Fortunati Macroello.	Great Barrington.		Convicted.	10 00	
Sebastian Demonge.	Great Barrington.		Convicted.	10 00	
Moses Maloff.	Ashland.		Convicted.	5 00	
Antonio Aurilia.	Framingham.		Convicted.	10 00	
Giuseppe Corticci.	Boston.		Convicted.	10 00	
Joseph Kanisawskaz.	Bridgewater.		Convicted.	10 00	
William Commette.	Springfield.		Convicted.	10 00	
Georami Baravalle.	New Bedford.		Convicted.	10 00	Filed. Filed.
Paul Lombardo.	New Bedford.		Convicted.	—	

Piacentino Dominico, . . .	Convicted, . . .	10 00	
Peter Roberchi, . . .	Convicted, . . .	10 00	
Giovanna Deardi, . . .	Convicted, . . .	25 00	
Baptiste G. Dolci, . . .	Convicted, . . .	25 00	
Tonio Lonelli, . . .	Convicted, . . .	25 00	
Dominico Coroli, . . .	Convicted, . . .	25 00	
Frank Costiglia, . . .	Convicted, . . .	10 00	
Angelo Givarolla, . . .	Convicted, . . .	10 00	
Romas Worack, . . .	Convicted, . . .	10 00	
Jacob Faustini, . . .	Convicted, . . .	20 00	
G. Catrambone, . . .	Convicted, . . .	10 00	Also Sunday hunting.
Brunius Froio, . . .	Convicted, . . .	10 00	Failed to pay; jail.
Giovanna Fusco, . . .	Convicted, . . .	10 00	Defaulted.
Charles Lugero, . . .	Convicted, . . .	10 00	
Dominique Morellis, . . .	Convicted, . . .	10 00	
J. W. Manners, . . .	Discharged, . . .	—	Not pressed to avoid a criminal record.
Arthur Watmough, . . .	Discharged, . . .	—	
Michael Consolvas, . . .	Convicted, . . .	5 00	
F. A. Shores, . . .	Discharged, . . .	—	
Fred Pease, . . .	Discharged, . . .	—	
Walter E. Bowman, . . .	Convicted, . . .	20 00	
Fred C. Maunch, . . .	Convicted, . . .	6 00	
Joseph Lafrance, . . .	Convicted, . . .	6 00	
Manuel Frates, . . .	Convicted, . . .	5 00	
Clarence W. Chase, . . .	Convicted, . . .	15 00	
Henry Lord, . . .	Convicted, . . .	5 00	
John Fish, Jr., . . .	Convicted, . . .	9 00	
James Tompkins, . . .	Convicted, . . .	5 00	
Thomas E. Ross, . . .	Convicted, . . .	5 00	
Thomas D. Alger, . . .	Convicted, . . .	2 00	
Joseph Coffin, . . .	Discharged, . . .	—	
Albert Cann, . . .	Discharged, . . .	—	
George B. Lane, . . .	Convicted, . . .	5 00	Filed.
George Normandie, . . .	Convicted, . . .	—	
Leopoldo Castiglioni, . . .	Convicted, . . .	15 00	
Kyeled Johnson, . . .	Convicted, . . .	—	Filed; killed dogs.
Frank Lassone, . . .	Convicted, . . .	—	Filed; by order of court.
James A. Murchie, . . .	Discharged, . . .	—	
Pontini Giuseppe, . . .	Convicted, . . .	10 00	
Erastus J. Norton, . . .	Convicted, . . .	—	Placed on probation.
Harold Hamilton, . . .	Convicted, . . .	—	Placed on probation.
John Schwistk, . . .	Convicted, . . .	—	Filed; alien without license.
John Anastasi, . . .	Convicted, . . .	10 00	
Gaetano Mohibia, . . .	Convicted, . . .	—	Filed.
Anthony Conti, . . .	Convicted, . . .	10 00	
Gaetano Pino, . . .	Convicted, . . .	20 00	
Joseph Simi, . . .	Convicted, . . .	10 00	
Louis Deep, . . .	Convicted, . . .	—	Filed.
Framingham, . . .	Convicted, . . .	10 00	
Framingham, . . .	Convicted, . . .	10 00	
Leominster, . . .	Convicted, . . .	25 00	
Leominster, . . .	Convicted, . . .	25 00	
Leominster, . . .	Convicted, . . .	25 00	
Leominster, . . .	Convicted, . . .	25 00	
Monson, . . .	Convicted, . . .	10 00	
Framingham, . . .	Convicted, . . .	10 00	
Chicopee Falls, . . .	Convicted, . . .	10 00	
North Adams, . . .	Convicted, . . .	20 00	
Brockton, . . .	Convicted, . . .	10 00	
Brockton, . . .	Convicted, . . .	10 00	
Lincoln, . . .	Convicted, . . .	—	
Boston, . . .	Convicted, . . .	10 00	
Maynard, . . .	Convicted, . . .	10 00	
Maynard, . . .	Discharged, . . .	—	
Maynard, . . .	Discharged, . . .	—	
Scoaticut, . . .	Discharged, . . .	5 00	
New Bedford, . . .	Discharged, . . .	—	
Scoaticut, . . .	Discharged, . . .	—	
Mattapoissett, . . .	Convicted, . . .	20 00	
Hull, . . .	Convicted, . . .	6 00	
Nahant, . . .	Convicted, . . .	6 00	
New Bedford, . . .	Convicted, . . .	5 00	
New Bedford, . . .	Convicted, . . .	15 00	
Fall River, . . .	Convicted, . . .	5 00	
Brockton, . . .	Convicted, . . .	9 00	
Boston, . . .	Convicted, . . .	5 00	
Boston, . . .	Convicted, . . .	5 00	
Boston, . . .	Discharged, . . .	—	
Boston, . . .	Discharged, . . .	—	
Boston, . . .	Convicted, . . .	5 00	
Boston, . . .	Convicted, . . .	15 00	
Warren, . . .	Convicted, . . .	—	
Millford, . . .	Convicted, . . .	—	
Monson, . . .	Convicted, . . .	—	
Warren, . . .	Convicted, . . .	—	
Harvard, . . .	Discharged, . . .	—	
Framingham, . . .	Convicted, . . .	10 00	
Saugus, . . .	Convicted, . . .	—	
Saugus, . . .	Convicted, . . .	—	
Taunton, . . .	Convicted, . . .	—	
John Schwistk, . . .	Convicted, . . .	10 00	
John Anastasi, . . .	Convicted, . . .	—	
Boston, . . .	Convicted, . . .	10 00	
Boston, . . .	Convicted, . . .	20 00	
Boston, . . .	Convicted, . . .	10 00	
Boston, . . .	Convicted, . . .	20 00	
North Adams, . . .	Convicted, . . .	10 00	

Hunting without license in violation of c.
317, Acts of 1905.

Having short lobsters in violation of § 88,
c. 91, R. L., as amended by c. 303, Acts
of 1907.

Dogs chasing deer in violation of § 18, c.
92, R. L., as amended by c. 245, Acts
of 1905.

Killing song birds in violation of § 7, c.
92, R. L., as amended by c. 250, Acts
of 1907.

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Continued.

STATE v. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Joseph Vincent.	Hardwick.	Illegal possession of game under laws relative to close seasons.	Convicted,	\$10 00	Filed.
C. H. Richardson, Jr.	Newburyport.		Convicted,	10 00	Filed; see Sunday hunting.
Samuel Chapman.	Mansfield.		Convicted,	—	Filed; see Sunday hunting.
Thomas Nutley.	Boston.		Convicted,	—	Filed; see Sunday hunting.
Edmund Pruex.	Beverly.		Convicted,	—	Filed; see Sunday hunting.
Medine Trembley.	Salem.		Convicted,	—	Filed; see Sunday hunting.
Louis Letarte.	Salem.		Convicted,	—	Filed; see Sunday hunting.
Edward J. Cummings.	Salem.		Convicted,	—	Filed; see Sunday hunting.
John H. Fallon.	Salem.		Convicted,	—	Filed; see Sunday hunting.
James Archibald.	Salem.		Convicted,	—	Filed; see Sunday hunting.
Isa C. Gaff.	Campello.		Convicted,	10 00	See also Sunday hunting.
William Barry.	Campello.		Convicted,	—	Filed; see alien without license.
Fred Hathaway.	Rehoboth.		Convicted,	10 00	—
Theodore H. Forgeon.	Plymouth.		Convicted,	10 00	—
Piacentino Dominico.	Frammingham.		Convicted,	10 00	—
Louis Scanelli.	Fall River.		Convicted,	10 00	—
George Lavigne.	Fall River.		Convicted,	40 00	—
Niere Marchand.	Westport.		—	—	Defaulted.
Charles Tripp.	Agawan.		—	20 00	Filed
Joseph McCarthy.	Lincoln.		Convicted,	—	—
Giovanni Fusco.	Ashby.		Convicted,	10 00	—
Charles Kimball.	Northampton.		Convicted,	10 00	—
Walter Jarvis.	Northampton.		Convicted,	10 00	—
Joseph Torr.	Northampton.		Convicted,	10 00	—
Louis Dimond.	Northampton.		Convicted,	10 00	—
Bernard Cantwell.	Pittsfield.		Convicted,	10 00	—
Louis J. Marel.	Springfield.		Convicted,	10 00	—
Charles H. Tift.	Worcester.		Convicted,	10 00	—
William W. Granger.	Hubbardston.	Having short trout in possession in violation of § 64, c. 91, R. L., as amended by c. 190, Acts of 1905,	Convicted,	10 00	—
James A. Brennan.	Hubbardston.		Convicted,	10 00	—
Lewis Pomeroy.	Westfield.		Convicted,	10 00	—
Caleb J. Hawksworth.	Pittsfield.		Convicted,	10 00	—
G. I. Hays.	Westfield.	Killing deer in violation of § 17, c. 92, R. L., as amended by c. 307, Acts of 1907,	Convicted,	—	Filed.
Arthur Hays.	Westfield.		Convicted,	20 00	—
Andrew J. Pollock.	Easthampton.		Discharged,	—	—
Thomas Flanagan.	Springfield.		Convicted,	100 00	Filed in Superior Court.
Fred L. Harvey.	William W. Newman.		Convicted,	—	—
William W. Newman.	C. Y. Southard.		Convicted,	—	—
C. Y. Southard.	Groton.		Convicted,	—	—
Mervin E. Dodge.	North Prescott.		Convicted,	—	—
Danford W. Sikes.	Ludlow.		Convicted,	—	—

Arthur G. Downing,	Ayer,	Convicted,	20 00	Filed.
Stephen Krol,	Webster,	Convicted,	—	Filed.
John Paezek,	Webster,	Convicted,	—	Filed.
Jacob Willock,	Webster,	Convicted,	—	Filed.
Edward Sheehan,	Webster,	Convicted,	—	Filed.
Eaca Strike,	Webster,	Convicted,	—	Filed.
Joseph Lavelle,	Webster,	Convicted,	—	Filed.
Harold E. Rusdler,	Abington,	Discharged,	—	
John E. Nilson,	Brighton,	Discharged,	—	
Luther Hanson,	Newton,	Discharged,	—	
Frank Badger,	Avon,	Convicted,	25 00	Paid costs of court, \$10.
Waldo Drake,	Hanson,	Convicted,	—	
Meriton Drake,	Pembroke,	Convicted,	—	Filed.
Antonius D. Zingel,	Brockton,	Convicted,	20 00	
Antonius Yestminas,	Brockton,	Convicted,	—	Filed.
Jonas Berys,	Brockton,	Convicted,	20 00	
Marin Antonyte,	Brockton,	Convicted,	20 00	
William Ludwinavile,	Brockton,	Convicted,	20 00	
John Keith,	Brockton,	Convicted,	—	Paid costs of \$5.
Simeon Chase,	Brockton,	Convicted,	30 00	Defaulted.
John Doe,	Brockton,	Convicted,	—	
Mike —,	Brockton,	—	—	
Andrew McGlynn,	Taunton,	—	—	
John Smith,	Taunton,	Convicted,	20 00	
Fred H. Cummings,	Taunton,	Convicted,	20 00	
Fred N. Staples,	Taunton,	Convicted,	20 00	
Ephram Mann,	Everett,	Convicted,	20 00	
W. E. Danforth,	Boston,	Convicted,	20 00	
Eugene Kane,	Natick,	Convicted,	20 00	
Richard Wiley,	Norton,	Convicted,	20 00	
Andrea Castellani,	North Adams,	Convicted,	20 00	
George R. Phillips,	Dennis,	Convicted,	20 00	
James C. Kelley,	Dennis,	Convicted,	20 00	
Edward G. Caltoon,	Dennis,	Convicted,	20 00	
Wendell Eldredge,	Harwich,	Convicted,	20 00	
Morris J. Halpin,	Warechester,	Convicted,	20 00	
Alvin Moore,	Bellingham,	Convicted,	15 00	
Patrick Bresnahan,	Holyoke,	Convicted,	20 00	
Michael Fox,	Holyoke,	Convicted,	20 00	
Oswald Klugel,	Easthampton,	Discharged,	—	
George Nelson,	Huntington,	Discharged,	—	Filed.
Preston Armitage,	Shirley,	Convicted,	—	Filed.
W. H. Pike,	Shirley,	Convicted,	10 00	
John Brussiere,	Weymouth,	Convicted,	25 00	
Oscar Rogers,	Newbury,	Convicted,	25 00	
Charles E. Adams,	Newbury,	Convicted,	—	

Report upon Convictions, Fines, etc., for Violations of the Fish and Game Laws — Concluded.

STATE P. —	TOWN OR CITY.	Offence.	Court Decision.	Fine.	Remarks.
Frank King.	Attleborough.	Using more than one hook on stocked pond.	Convicted.	\$20 00	
Howard E. Tingley.	North Attleborough.	Killing eagle in violation of c. 118, Acts of 1907.	Convicted.	20 00	Filed.
Irving Durkee.	Danvers.	Killing loon on fresh water in violation of c. 118, Acts of 1907.	Convicted.	—	Filed.
Herbert R. Caboon.	Harwich.		Convicted.	—	Filed.
Frederick S. Cook.	Newark, N. J.		Convicted.	—	
William Costen.	State Line, N. Y.		Convicted.	30 00	
Daniel Phelps.	South Williamstown.		Discharged.	—	
Robert Steele.	South Williamstown.	Dynamiting waters in violation of § 133, c. 91, R. L., as amended by c. 246, Acts of 1903.	Discharged.	—	
Ephraim Munson.	Chesterfield.		Convicted.	10 00	
William F. Leonard.	Chesterfield.		Convicted.	20 00	
Rockwell D. Bisbee.	Chesterfield.		Convicted.	20 00	
John DeGood.	Mattapoisett.	Seining in Buzzards Bay in violation of § 122, c. 91, R. L.	Convicted.	25 00	
Albert D. Peters.	Mattapoisett.		Convicted.	25 00	
Charles W. Cook.	East Fairhaven.		Convicted.	25 00	
Herbert Crosby.	Osterville.	Violation of c. 301, Acts of 1907.	Discharged.	—	
Alfred Lewis.	Cheshire.	Spearing fish in violation of § 132, c. 91, R. L.	Convicted.	10 00	
Paul Kronsh.	Holyoke.	Having short pickerel in violation of § 67, c. 91, R. L., as amended by c. 329, Acts of 1904.	Convicted.	9 00	
Peter Synk.	Holyoke.		Convicted.	12 00	
John Schneider.	Holyoke.		Convicted.	—	Filed; see short pickerel.
Peter Synk.	Holyoke.		Convicted.	—	Filed; see short pickerel.
John Schneider.	Holyoke.	Having short bass in violation of § 70, c. 91, R. L.	Convicted.	—	Filed.
John Saunders.	Westfield.		Discharged.	—	
Louis Coleman.	Quincy.	Killing wood duck in violation of c. 274, Acts of 1906.	Convicted.	5 00	
Aphonso Williams.	Nahum Hall.	Seining trout.	Convicted.	—	
Nahum Hall.	Middleborough.	Seining in pond in violation of § 26, c. 91, R. L., as amended by c. 308, Acts of 1904.	Discharged.	30 00	Failed to pay; jail three months.
Walter Moran.	Southwick.		Convicted.	—	
Fred Abbott.	Ware.		Discharged.	—	
John Marland.	Ware.		Discharged.	—	
Luce Boccone.	New York.		Discharged.	—	
Frederick S. Cook.	Newark, N. J.	Non-residents hunting without license in violation of c. 198, Acts of 1907.	Convicted.	10 00	Filed.
Herbert Cooper.	Broomfield, Vt.		Convicted.	5 00	
Fred E. Mann.	Weymouth.		Discharged.	—	
Wallace J. Cook.	Provincetown.	Maintaining fish trap without permit in violation of § 118, c. 91, R. L.	Convicted.	210 00	Filed.
Normand S. Cook.	Provincetown.		Convicted.	—	

Otis E. Kelley, . . .	Dennis Port, . . .	Convicted, . . .	20 00
John Forsia, . . .	New Bedford, . . .	Convicted, . . .	20 00
George B. Gallagher, . . .	Boston, . . .	Convicted, . . .	20 00
Charles C. King, . . .	Boston, . . .	Convicted, . . .	20 00
Charles Martin, . . .	New Bedford, . . .	Convicted, . . .	20 00
Michael P. Melle, . . .	Pittsfield, . . .	Discharged, . . .	—
John Leary, . . .	Arlington, . . .	Convicted, . . .	5 00
David C. Law, . . .	Lynn, . . .	Convicted, . . .	5 00
August Lavioie, . . .	Lynn, . . .	Convicted, . . .	20 00
Henry Reardon, . . .	Lynn, . . .	Convicted, . . .	—
G. F. Linehan, . . .	Lynn, . . .	Convicted, . . .	—
David Lavioie, . . .	Marshfield, . . .	Discharged, . . .	—
Edward Arnold, . . .	Marshfield, . . .	Discharged, . . .	—
William D. Ewell, . . .	Marshfield, . . .	Discharged, . . .	—
George C. Packham, . . .	Fall River, . . .	Convicted, . . .	—
Joseph Fox, . . .	Fall River, . . .	Convicted, . . .	10 00
Charles Gilbert, . . .	Fall River, . . .	Convicted, . . .	—
Charles Billeau, . . .	Fall River, . . .	Discharged, . . .	10 00
Amade Fournier, . . .	Fall River, . . .	Discharged, . . .	—
Simeon Atwood, . . .	Boston, . . .	Convicted, . . .	30 00
Daniel O'Connell, . . .	Brockton, . . .	Discharged, . . .	—
Ezeb Lucien, . . .	Brockton, . . .	Discharged, . . .	—
Lloyd Dean, . . .	Brockton, . . .	Discharged, . . .	—
Fred Coots, . . .	Brockton, . . .	Discharged, . . .	—
Albert Pike, . . .	Brockton, . . .	Discharged, . . .	—
Hermitous Goulet, . . .	Marlborough, . . .	Convicted, . . .	7 00
Antonio Pino, . . .	Marlborough, . . .	Convicted, . . .	7 00
Isaac Harvey, . . .	Essex, . . .	Convicted, . . .	10 00
Edward Peabody, . . .	Essex, . . .	Convicted, . . .	10 00
Antone Bringoli, . . .	Boston, . . .	Discharged, . . .	—
Paolo Merlino, . . .	Boston, . . .	Discharged, . . .	—

Filed.
Filed.
Out of jurisdiction.
Out of jurisdiction.
Out of jurisdiction.
Paid costs, \$2.60.
Paid costs, \$5.60.

All minors; were severely reprimanded by the judge.

[F.]

RETURNS FROM THE SHORE POUND AND NET FISHERIES FOR THE YEAR 1907.

Apparatus employed.

PROPRIETOR.	TOWN.	Number of Men.	Boats.	Value.	Pounds.	Value.	Nets.	Value.
Edward Holway,	Bournedale,	2	3	\$175 00	1	\$1,200 00	-	-
J. Eldredge & Son,								
Gilbert E. Ellis,								
A. S. Hall,	Brewster,	22	14	1,295 00	22	8,710 00	4	\$55 00
James F. Higgins,								
E. C. Jerauld,								
David A. Newcomb,								
Fred Young,								
Fred W. Baker,								
Consolidated Weir Company,								
George W. Crowell,	Chatham,	16	12	4,170 00	8	6,100 00	56	575 00
Geo. F. Nickerson,								
R. A. Nickerson,								
Albert W. Smith,								
F. C. Flanders & Co.,	Chilmark,	16	14	1,300 00	10	6,500 00	-	-
W. F. Flanders,								
D. W. West,	Cuttyhunk,	4	5	1,270 00	1	1,200 00	1	50 00
Frank B. Veeder & Co.,								
Crowell Cold Storage Company,	Dennis,	13	10	1,127 00	5	4,000 00	-	-
Zenas H. Baker,								
Chas. Gardner,	Dighton,	18	9	435 00	-	-	10	660 00
E. D. Perry,								
Albert F. Simmons,								

David B. Pease and Allen Mayhew, E. R. Durkee and W. F. Vincent, D. D. Diamond & Co., Linus S. Jeffers & Co., A. H. Vanderhoop & Co., L. L. Vanderhoop & Co., Fuller A. Andrews, George W. Douglass, Joseph Douglass, Thomas Douglass, Henry W. Nelson, Alexander Sargent, Frank A. Tarr, Walter F. Kelley, Orin S. Crosby, Moses Sturges, Taylor Brothers, Alfred W. Riley, Edw. Heath & Co., A. L. Holmes, H. D. Powell, (F. H. Johnson and others), Avarad L. Smith, (R. A. Atwood and others), Arthur J. Barrett & Co., Edward I. Fisher, C. S. Glidden & Co., George H. Hamblin, Arthur McCleare, W. F. Ramsdell, Alexander C. Swain, John S. Watkins, George M. Winslow, C. A. Caswell & Co., George G. Short, Atkins, Hughes & Co., Allen R. Norton, Agent, Caleb Hayden, L. W. Raymond, Warren Cove Weir Company,
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Apparatus employed — Concluded.

PROPRIETOR.	TOWN.	Number of Men.	Boats.	Value.	Pounds.	Value.	Nets.	Value.
James F. Atkins.
Stephen F. Atwood,
Manuel Carter,
J. K. Cobb,
R. W. Cook,
A. L. Daggett,
Joseph H. Emery,
Prince Freeman,
James W. Fuller,
Luther P. Hatch,
A. P. Lewis and Manuel James,
John Johnson,
William Josephs,
James E. Kelley,
R. O. Kelley,
Thomas J. Lewis,	.	77	75	\$19,806 00	11	\$11,800 00	771	\$7,104 00
Consolidated Weir Company,	Provincetown,	.	.	.	.	.	.	.
Eastern Weir Company,
William B. Lewis,
Alfred A. Mayo,
Herman L. Mayo,
Martin Nelson,
Frank V. Perry,
Frank I. Sears,
Edwin W. Smith,
H. N. Smith,
John S. Smith,
John R. Swartz,
Manuel P. Vera,
William Wareham,
J. W. Weeks,
J. R. Williams,	.	15	7	275 00	-	-	3	300 00
G. B. Williams,	.	-	-	-	-	-	-	-
Manuel Marshall,
Antone Vera,	.	1	1	15 00	-	-	10	50 00
Melvin Rich,
John Elvander,	.	2	2	360 00	1	1,200 00	6	30 00
E. W. Haines,
A. W. Goff,	Segregansett,	11	4	80 00	-	-	4	300 00
	Raynham,	.	.	.	.	.	.	.
	Robinsons' Hole,	.	-	-	-	-	-	-
	Rockport,	1	1	15 00	-	-	10	50 00
	Sandwich,	2	2	360 00	1	1,200 00	6	30 00
	Segregansett,	.	.	.	.	.	.	.

	13	3	130 00	-	2	300 00
J. H. Miller,
H. W. Daggett,
Obed S. Daggett,
George H. Luce,
H. Nelson Luce,
George W. Manter,
J. A. Mayhew & Co.,
W. L. and G. F. Tilton,
John R. Walker,
George Cleveland,
Eben Luce,
Otis B. Luce,
B. S. Paine,
John J. Veeder,
Hiram E. Baker,
Totals for State,	363	325	\$65,537 00	126	\$96,385 00	\$17,209 00

Number of Pounds of Fish taken

TOWN.	Alewives.	Bluefish.	Flounders.	Mackerel.	Menhaden.	Pollock.	Salmon.	Seap.
Bournedale, . . .	-	-	-	6,270	-	6,185	-	-
Brewster, . . .	20,228	200	16,305	100,752	-	34,034	-	-
Chatham, . . .	-	62	35,150	23,135	-	676	-	-
Chilmark, . . .	605	-	22,934	10,754	-	-	-	102,200
Cuttyhunk, . . .	-	-	10,000	100	-	20,000	-	90,000
Dennis, . . .	14,850	-	16,800	32,117	-	365	-	615
Dighton, . . .	137,350	-	-	-	-	-	-	-
Edgartown, . . .	900	21	1,250	525	-	-	-	2,550
Gay Head, . . .	2,000	-	440	13,200	-	11,200	-	171,000
Gloucester, . . .	9,000	-	2,500	25,299	-	613,402	15	-
Hull, . . .	110,000	-	12,000	-	-	-	-	-
Hyannis, . . .	-	1,000	200	29,880	-	-	-	-
Lanesville, . . .	-	-	-	-	-	-	-	-
Manchester, . . .	5,900	-	-	5,157	-	58,064	-	528
Manomet, . . .	-	-	-	66	125	-	-	-
Nahant, . . .	-	-	-	500	-	43,315	-	-
Nantucket, . . .	12,400	8,418	8,028	52,081	-	118,150	-	16,300
Newburyport, . . .	-	-	-	1,400	-	300,825	-	-
North Truro, . . .	60,700	-	87,690	97,392	-	332,500	-	-
Oak Bluffs, . . .	3,500	-	-	-	-	-	-	-
Orleans, . . .	-	-	4,000	-	-	-	-	-
Plymouth, . . .	-	-	-	-	-	2,500	-	-
Provincetown, . . .	-	-	679,102	366,370	-	188,477	-	-
Raynham, . . .	90,000	-	-	-	-	-	-	-
Robinson's Hole, . . .	-	-	1,600	10,367	3,200	-	-	-
Rockport, . . .	-	-	-	197	-	6,757	-	-
Sandwich, . . .	-	-	-	23,949	-	13	-	-
Segregansett, . . .	115,000	-	-	-	-	-	-	-
Somerset, . . .	75,000	-	-	-	-	-	-	-
Tisbury, . . .	14,500	1,311	20,350	15,025	200	8,750	-	26,150
Vineyard Haven, . . .	5,000	26	4,185	472	-	100	-	10,700
Wellfleet, . . .	-	-	-	-	-	-	-	-
Woods Hole, . . .	-	-	-	-	-	-	-	-
Yarmouth, . . .	43,000	-	-	-	-	-	-	-
Totals for State, . .	621,113	11,038	922,534	816,915	3,525	1,745,313	15	420,043

in Nets, Pounds, Traps, etc.

Sea Bass.	Sea Herring.	Slad.	Squeteague.	Striped Bass.	Squid.	Tautog.	Other Edible or Bait Species.	Refuse Fish.	Total Value.
-	-	1,234	1,276	-	15,800	1,151	16,173	-	\$1,339 67
-	139,600	22,211	36,442	136	20,725	2,058	57,446	-	12,024 21
-	3,375	9,700	137,993	41,000	65,500	135	37,917	-	11,261 00
550	-	5	265,394	-	-	80	200	20,000	14,368 16
10,000	-	-	100,000	-	-	500	-	-	6,765 00
-	68,290	7,539	26,310	-	273,425	1,170	89,150	4,765	8,129 68
-	-	5,085	700	-	-	-	9,800	-	2,727 70
100	-	250	219,803	-	1,000	-	5,200	-	1,372 23
3,100	-	20	246,480	-	600	-	-	-	17,133 30
-	103,420	44,746	-	-	-	-	1,202,469	79,975	14,983 50
-	-	-	-	-	-	-	-	-	350 00
-	-	-	7,500	146	-	-	400	-	3,056 71
-	5,950	-	-	-	-	-	-	-	158 50
-	38,068	1,828	-	-	600	-	140,578	-	2,560 85
-	-	-	-	-	-	-	-	-	10 42
-	865,900	-	-	-	-	-	455,072	-	12,768 54
230	-	225	219,907	30	2,000	300	123,800	-	20,882 67
-	114,200	-	-	-	-	-	57,375	-	5,020 60
-	537,100	428	70,132	-	449,200	-	1,273,645	-	32,571 29
-	-	-	-	-	-	-	400	-	99 85
-	-	-	-	-	-	-	-	-	40 00
-	-	35	3,350	-	7,600	876	21,404	-	820 14
-	291,580	-	14,380	-	81,333	20,000	315,813	298,440	52,819 44
-	-	830	-	-	-	-	-	-	945 25
-	-	-	-	-	-	-	-	-	494 68
-	-	-	-	-	400	-	5,327	-	238 10
-	200	1,024	5,057	-	2,307	-	5,380	-	2,461 75
-	-	1,750	-	-	-	-	-	-	1,430 00
-	-	450	-	-	-	-	1,000	-	1,064 00
695	-	50	632,240	110	3,100	6,680	985	-	28,503 92
50	-	-	126,348	-	1,600	650	670	-	4,893 75
-	-	-	-	-	-	-	2,500	-	175 00
-	-	-	7,800	-	4,100	-	-	-	226 00
-	-	-	-	-	-	-	-	-	432 00
14,725	2,167,683	97,410	2,121,112	41,422	929,290	33,600	3,822,704	403,180	\$262,127 91

[illegible]

Returns from the Lobster Fisheries — Continued.

PROPRIETOR.	TOWN.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg- bearing Lobsters.
Daniel S. Crowell, Ansell P. Hovess, Benjamin Walker, Samuel P. Burgess, William E. Freeman, Isaac Symmes, Frank E. Wadsworth, Manuel Deloura, Levi Ripley, Alvin F. Bourne, Moses P. Cooper, Chas. S. Hatch, Joseph A. Lang, C. H. Ryan, Charles W. Ryan, Edward L. Ashley, Antone Burnham, Manuel Cardozo, Joseph Douglass, Frank A. Gove (R. L. Gove & Son), Nelson F. King, Peter Knutson, D. E. Mehlmann, Melvin Parsons, Jerry Phillips, E. L. Small, Daniel S. Webber, F. B. Brewer, William Gallagher, Walter W. Marchant, John Viator, Robert Brown, W. M. Cushing, George Delano,	Dennis, Duxbury, Edgartown, Falmouth, Gay Head, Gloucester,	3 4 2 1 6 20	3 7 2 2 10 24	\$85 00 380 00 70 00 115 00 803 00 1,607 00	52 175 84 30 187 759	\$50 25 270 00 84 00 45 00 183 00 824 25	1,420 14,050 3,175 311 7,592 24,537	\$253 75 1,953 63 388 20 124 20 837 30 4,327 25	108 95 1 17 129 239

W. M. Englestead,	11	22	4,315 00	1,280	2,455 00	51,787	9,917 06	723
Wilfred Keene,								
Charles Peterson,								
Chas. R. Peterson,								
Lyman Sears,								
A. I. Shaw,								
H. P. Tolman,								
W. H. Tolman,								
R. M. Cleverly,								
Walter F. Kelley,								
Fred C. Maunch,								
Ambrose Mitchell,								
Daniel Souther,	7	8	929 00	444	770 00	24,065	5,628 30	87
Orin Crosby,								
Moses Sturges,	4	4	1,115 00	30	13 00	532	85 83	2
Allen R. Gorham,	1	1	450 00	45	45 00	2,612	485 28	11
Alfred W. Riley,								
Geo. H. Woodbury,	4	4	65 00	155	145 00	7,611	1,295 60	53
Addison Woodbury,								
E. M. Poland,								
D. C. Jones,	2	2	60 00	95	130 00	2,752	426 55	63
L. O. Sargent,								
James Anderson,								
Fred W. Archibald,								
C. D. Bacon,								
A. L. Bartlett,								
Samuel H. Benson,								
G. L. Binney,								
Laban B. Briggs,								
C. H. Dixon,								
A. L. Holmes,								
Ralph B. Holmes,								
W. J. Nighthingale,								
Austin E. Parris,	22	35	2,597 00	1,292	1,946 00	106,204	14,832 64	984
F. R. Peterson,								
Archile Plouffe,								
Chas. W. Raymond,								
J. E. Raymond,								
Robert Richardson,								
A. C. Sampson,								
Allen R. Swift,								
C. A. Wakefield,								

E. H. Crowell,	10	10	880 00	1,300	1,400 00	14,234	3,178 08	73
Jas. S. Cunningham, . . . . .	.	.	.	.	.	.	.	.
Joseph Lafrance, . . . . .	.	.	.	.	.	.	.	.
W. A. Smith, . . . . .	.	.	.	.	.	.	.	.
Charles Taylor, . . . . .	.	.	.	.	.	.	.	.
G. H. Lamphier, . . . . .	.	.	.	.	.	.	.	.
Benjamin Atwood, . . . . .	.	.	.	.	.	.	.	.
Chas. A. Bridgman, . . . . .	.	.	.	.	.	.	.	.
George L. Hatch, . . . . .	.	.	.	.	.	.	.	.
Henry E. Hatch,	8	9	305 00	335	505 00	24,065	4,822 60	104
Samuel McDonald, . . . . .	.	.	.	.	.	.	.	.
Ephraim Onderkirk, . . . . .	.	.	.	.	.	.	.	.
Simon Rogers, . . . . .	.	.	.	.	.	.	.	.
Leland S. Topham, . . . . .	.	.	.	.	.	.	.	.
E. C. and J. E. Chapel, . . . . .	.	.	.	.	.	.	.	.
J. H. Dennis, . . . . .	.	.	.	.	.	.	.	.
Harry E. Dunham, . . . . .	.	.	.	.	.	.	.	.
R. S. K. Dunham, . . . . .	.	.	.	.	.	.	.	.
Chas. C. Eldredge,	13	17	1,657 00	435	581 00	11,373	2,437 16	314
Wm. H. Hamblin, . . . . .	.	.	.	.	.	.	.	.
W. H. Norcross, . . . . .	.	.	.	.	.	.	.	.
Joseph H. Ray, . . . . .	.	.	.	.	.	.	.	.
Manuel Thomas, . . . . .	.	.	.	.	.	.	.	.
John S. Watkins, . . . . .	.	.	.	.	.	.	.	.
Thos. B. Dowling,	4	5	1,365 00	200	250 00	15,441	1,861 08	180
Bartholomew Silva, . . . . .	.	.	.	.	.	.	.	.
George B. Taber,	1	1	20 00	30	40 00	3,595	647 50	-
Samuel DeCoste,	1	1	20 00	12	12 00	200	50 00	25
Joseph Allen, . . . . .	.	.	.	.	.	.	.	.
H. C. Goodspeed,	2	6	1,540 00	110	110 00	2,464	515 63	56
George H. Hallett, . . . . .	.	.	.	.	.	.	.	.
Daniel B. Gould, . . . . .	.	.	.	.	.	.	.	.
Caleb Hayden,	5	5	790 00	105	190 00	1,589	664 78	25
M. M. Pierce, . . . . .	.	.	.	.	.	.	.	.
J. H. Bagnall, . . . . .	.	.	.	.	.	.	.	.
H. J. Caswell, . . . . .	.	.	.	.	.	.	.	.
D. J. Graffam, . . . . .	.	.	.	.	.	.	.	.
J. R. Harlow, . . . . .	.	.	.	.	.	.	.	.
Albert F. Pierce,	9	15	1,343 00	462	744 00	32,700	4,661 99	84
L. W. Raymond, . . . . .	.	.	.	.	.	.	.	.
Frank Simmons, . . . . .	.	.	.	.	.	.	.	.
J. P. Thurston, . . . . .	.	.	.	.	.	.	.	.
Martin Nelson, . . . . .	.	.	.	.	.	.	.	.
Joseph S. Perry, . . . . .	.	.	.	.	.	.	.	.
John W. Savage, . . . . .	.	.	.	.	.	.	.	.
W. C. Snow,	4	5	525 00	280	265 00	2,123	754 55	109
Provincetown, . . . . .	.	.	.	.	.	.	.	.
Nahant, . . . . .	.	.	.	.	.	.	.	.
Nantasket, . . . . .	.	.	.	.	.	.	.	.
Nantucket, . . . . .	.	.	.	.	.	.	.	.
New Bedford, . . . . .	.	.	.	.	.	.	.	.
North Scituate, . . . . .	.	.	.	.	.	.	.	.
North Tisbury, . . . . .	.	.	.	.	.	.	.	.
Onset, . . . . .	.	.	.	.	.	.	.	.
Orleans, . . . . .	.	.	.	.	.	.	.	.
Plymouth, . . . . .	.	.	.	.	.	.	.	.
Provincetown, . . . . .	.	.	.	.	.	.	.	.

Returns from the Lobster Fisheries — Concluded.

PROPRIETOR.	TOWN.	Number of Men.	Number of Boats.	Value.	Number of Pots.	Value.	Number of Lobsters.	Value.	Number of Egg- bearing Lobsters.
Manuel Marshall, Antone Vera, George E. Wendell and W. E. Nor- wood.	Robinson Hole,	2	2	\$800 00	136	\$130 00	4,884	\$701 17	93
Peter Dixon, George Dobson, A. Rich, S. D. Thurston, Jr., William Bennett, John Bowman, Martin Bowman, Joseph Dobson, Frank Gaspee, John F. Lawson, David B. Newcomb, Jr., Ernest M. Rich, A. J. Chandler, Arthur Gibbs, P. H. Marsh, William Norris, Charles S. Brown, John A. Dunn, Charles L. Wales, John Elvander, E. W. Haines, John F. Mahoney, W. H. Veeder, J. Frank Cushman, Charles DeCoste, Thomas Dwyer, Edward E. Edson, George F. Edson, Chas. Alfred Foster, Richard Graham, Elijah P. Pratt, John Stonefield,	.	15	21	2,613 00	1,395	1,840 00	55,480	8,988 24	219
.	Rockport,	.	.	.	.	.	.	.	.
.	Sagamore,	4	7	130 00	95	89 00	2,441	326 42	81
.	Salem,	3	4	670 00	245	265 00	16,033	3,206 60	287
.	Sandwich,	4	5	517 00	129	172 50	3,671	561 50	63
.
.	Seituate,	12	17	2,665 00	680	1,110 00	45,497	6,202 72	364

Thomas Turner,	2	6	445 00	148	200 00	9,547	1,791 25	111
Seth Vinal,								
Daniel Ward,								
Frank E. Phillips,								
S. G. T. Wadsworth,	-	-	-	16	32 00	900	126 00	20
J. A. Mayhew & Co.,								
William A. Day,								
William M. Pease,	5	8	415 00	85	85 00	2,750	484 13	40
Edward H. Smith,								
L. E. Smith,								
James R. Tilton,								
F. J. Densmore,								
Mayhew C. Stuart,	2	3	50 00	25	25 00	485	101 15	45
David T. Butler,								
Lester D. Mayhew,	5	9	1,893 00	290	457 50	16,102	2,087 82	215
Lindley W. Mayhew,								
George A. Rogers,								
George A. Gifford,								
William A. Hammond,								
William S. Head,	8	9	2,275 00	271	295 25	16,858	2,667 06	315
Harry G. Soble,								
William B. Whalen,								
Francis J. Cain,	2	1	300 00	180	270 00	12,410	3,079 00	101
Hartley L. Wells,	1	1	50 00	60	75 00	3,416	683 30	-
L. L. Adams,								
James F. Cook,								
Chas. R. Grinnell,								
Oscar R. Hilton,								
Thomas Hineley,	11	15	2,200 00	295	410 25	20,743	2,640 19	343
Wm. R. McDowell,								
Alfred Nickerson,								
Walter E. Nickerson,								
Prince M. Stuart,								
A. H. Vedeler,								
Shirley D. Lovell,	1	2	210 00	40	40 00	1,198	335 00	36
Totals for State,	379	523	\$65,162 00	21,342	\$28,668 68	1,039,886	\$174,364 17	10,340





